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NEW YORK, SATURDAY, OCTOBER 26, 1912.

CONTENTS.

Editorials 855
Convention of the Association of Railway Electrical Engineers..... 858
Central-Station Developments at Louisville, Ky..... 858
Electrical Development Society Organization Details..... 858
Proposed National Commission to Solve Water-Power Problems..... 859
Annual Report of Western Union Telegraph Company..... 859
Expansion of the Narragansett Electric Lighting Company..... 860
Kansas Utilities Convention..... 861
New England Section, N. E. L. A., Convention..... 863
The Appraisal of Intangible Values in Public Utilities..... 866
Public Service Commission News..... 867
Current News and Notes..... 868
Rock River Hydroelectric Development..... 871
Physical Photometers. By J. S. Dow..... 873
Recent Tendencies in Foreign Lighting Practice. By Dr. Louis Bell.. 875
Electric-Vehicle Batteries..... 876
Starting Devices for Alternating-Current Motors. By William E. Kampf 877
Replacing Air Lift with Deep-Well Pump..... 879
Short-Sighted Appliance Campaigns..... 879
Cost of Operating Electric Sand Pumps..... 879
City Advertising by Central Stations..... 879
Electric Light Companies at New York Electrical Show..... 880
Co-operative Street Lighting in Des Moines..... 881
Direct Advertising in a Sign Campaign..... 881
Electric Delivery Wagon for Grocer..... 881
Low-Frequency Flicker Cured by Two-Phase Wiring..... 882
Vancouver Illumination in Honor of Visit of Governor-General of Canada 882
Proposed "White Way" Lighting in Mobile..... 882
Special Illumination at Lebanon, Pa..... 883
Joints for Tubular Steel Poles..... 883
Indirect Lighting in a Confectionery Shop..... 884
Conduit Versus Open Work in Places Subject to Moisture, Corrosive Fumes, Steam, Etc.—III. By F. G. Waldenfels..... 884
Recent Telephone Patents..... 886
LETTER TO THE EDITORS:
The Lighting of Cars. By Frank T. Leilich..... 886
Digest of Current Electrical Literature..... 887
Book Reviews..... 890
New Apparatus and Appliances..... 891
Industrial and Financial News..... 896
Weekly Record of Electrical Patents..... 906

THE CENTRAL STATION AND THE WIRING CONTRACTOR.

In connection with the present movement for co-operation among the central stations, manufacturers, contractors and jobbers, it may be remarked of young industries in general, and the electrical industry in particular, that the initial or formative period is given largely to perfecting the product and finding a market for it, without much regard for the methods of distribution. Among the older industries, however, one finds that distribution, in the economic sense, is in most cases highly organized. That is to say, the respective positions of the manufacturer, the jobber, the wholesaler and the retail dealer are rather accurately defined, and each member feels bound to regard the rights of the others. But in the electrical industry this problem of distribution is only now beginning to receive adequate attention. There are in this industry five related interests which must be recognized, to wit: The central station, or producer and distributor of electrical energy; the manufacturer, or producer of electrical machinery, apparatus and appliances; the jobber, or distributor of electrical apparatus and merchandise; the supply dealer, or retailer who sells this apparatus and merchandise to the consumer, and the wiring contractor, who wires the consumer's premises and connects the central-station mains to the installation to be served.

At the recent Boston meeting of the New England Section of the National Electric Light Association, the concluding report of which appears elsewhere, a paper presented by Mr. E. M. Addis on the proper relation of the central station to the prospective consumer stirred up an important discussion which centered around the interrelations of the central station, the wiring contractor, and the supply dealer. There was almost unanimous agreement that the central station should co-operate with the contractor. The point was well made that it is fundamentally unsound for a central station to undertake wiring contracts at a loss in order to secure new customers. Another important point brought out during the discussion was the strong probability that many central stations do not include a fair allowance for overhead expenses in preparing their estimates for wiring installations. If a proper allowance of this character is made, it becomes more likely that the contractor can compete successfully, without sacrificing a reasonable profit to himself. The same thing is broadly true of the central station in the supply dealer's field, and in both instances a policy of mutual aid and co-operation will produce better permanent results than an attitude of hostility and harmful competition. This conviction is the moving spirit of the co-operative development associations now coming so actively to the fore and which seem likely to fill an important rôle in the future of the industry.

PHYSICAL PHOTOMETRY.

Mr. J. S. Dow's article on physical photometers in this issue is a well-considered discussion of the possibility of avoiding some of the troublesome errors which arise from the peculiarities of the eye in observing luminous surfaces. To substitute for the judgments of the eye some measurable physical effect independent of visual idiosyncrasies would certainly be a very desirable end. Thus far, however, it is unattained by any instrument yet devised. Three distinct groups of methods have been utilized for the purpose of physical photometry. The first of these is the photographic method, the second the radiometric method, and the third the indirect method by the light-sensitive cell and similar devices.

With respect to the photographic method trouble arises from the fact that the range of sensitiveness of photographic plates and papers to energy of different wave-lengths is extraordinarily different from that presented by the eye. The sensitiveness of the eye is greatly reduced in the blue and practically terminates with the end of the violet. Photographic emulsions of the usual kinds begin to show effect in the blue-green and continue it into the extreme ultra-violet. Some of them are so enormously sensitive in this latter region that a slip of paper covered in part by a bit of clear glass and exposed to a source rich in ultra-violet turns black in the unshielded portion before the part under the clear glass is perceptibly affected. Other emulsions are much less sensitive to the extreme ultra-violet, and so one can go on until some of the orthochromatic plates show a good degree of sensitiveness even to deep red. In order to obtain photometric results of value by photographic means one must devise an orthochromatic emulsion and suitable screens so that the curves of sensitiveness of the plate will coincide with the sensitiveness of the average eye, and even then differences are likely to be introduced by working with different lengths of exposure and using different developers. On the whole, therefore, the method is much better suited for comparative than for absolute work and breaks down conspicuously unless used under very closely standardized conditions.

The second, or radiometric, method requires the correlation of the energy in the spectrum of the illuminant to the effect produced on the average eye by the corresponding light. Consequently, while this method can be used for purely comparative purposes within reasonable limits, it, too, can hardly be considered as a substitute for ordinary photometry. It possesses, however, great usefulness in studying illuminants and for purposes of comparison. Of the light-sensitive cells selenium may be taken as a type. Recent investigations show that under closely controlled conditions selenium may prove a very useful adjunct in photometric work. Possibly by judicious screening its curve of sensitiveness could be made sufficiently near to that of the average eye to lead to valuable results; but this possibility has not been demonstrated under ordinary photometric conditions. The selenium cell is, however, extremely sensitive and reliable when carefully used for relative intensities under conditions where ordinary photometry is somewhat unsatisfactory. For example, the researches of Prof. Joel Stebbins on stellar photometry by means of the selenium cell have resulted in astonishingly accurate evaluations of the light of variable stars, materially better than could be made by the eye. The selenium cell, in fact, has added very much to our knowledge of such phenomena.

Up to the present all the physical methods of photometry have shown marked limitations and must be regarded as of special rather than general applicability. In the long run each of them must be correlated to the physiological characteristics of the average eye, and this constitutes one of the chief objections to their use. It is bad enough to have to deal with these physiological quantities directly, and it seems somewhat doubtful whether an indirect use of them by way of another set of variables can lead to any material simplification of the general problems of photometry.

THE PRIMER OF ILLUMINATION.

The Illuminating Engineering Society is to be congratulated on an important piece of constructive work achieved in publishing its primer on illumination, which is now being sent to all possible centers of distribution to the general public. The primer, which had its first publicity at the Niagara Falls convention of the society, as mentioned in our issue of Sept. 21, is precisely what its title indicates, a simple account of the foundamentals of illumination, written for the man on the street rather than the technician, and intended rather to guide him toward an appreciation of what illumination should be and can be than to give any cut-and-dried directions for installing this, that or the other illuminant. It cannot fail to serve a directly useful purpose, because the difficulty in carrying out a general program of good illumination is that the very rudiments, the principles on which good illumination should be based, are far from being as widely known as they should be. The primer should render valuable service in remedying this condition and making the ordinary intelligent person understand why certain things must be, and others must not be, done if artificial light is to be put to the best use. The illustrations tell the story almost without the text, and must have cost much trouble to secure.

On the subject matter there is little need to comment. It covers the rather wide ground of a somewhat difficult subject in small compass and so plainly that there is no room for misunderstanding as to the facts. It is earnestly to be hoped that it will be distributed very widely as an effective tract in the missionary work that is being done for good illumination and circulated thoroughly among consumers of gas and electricity to aid them in the effective use of these illuminants. We understand that central stations and gas companies have taken a very keen interest in the production of the primer and are preparing to employ it for the instruction of the public. It has been prepared merely as a primer, yet we have a well-grounded suspicion that a good many people who think they know something about the principles of illumination will find it by no means profitless reading. In bringing forth this primer the Illuminating Engineering Society has added another effective piece of work to its efforts at furthering the cause of good lighting and bringing the art of illumination to its proper place in the appreciation of the public.

ELECTRICAL MEASUREMENT OF WIND VELOCITY.

Among the papers read in the engineering section of the recent meeting of the British Association for the Advancement of Science at Dundee was one by Prof. J. T. Morris on the electrical measurement of wind velocity. Wind velocities, for meteorological purposes, are almost invariably measured by some form of Robinson anemometer. The usual form of this instrument consists of four metallic hemispherical cups mounted on the ends of four radial arms pivoted jointly about a vertical axis. The cups therefore run around in a horizontal plane under the mechanical difference of wind pressure exerted on their concave and convex sides. The speed of rotation increases with the wind velocity, although not in direct proportion, a correction formula being used when precision is aimed at. The instrument is handy, practical, easily self-recording and unlikely to get out of order. However, when a portable wind-velocity device is required the Robinson anemometer is unsuitable, and for very low wind velocities under any conditions this anemometer is not adapted.

The convection of heat from the surface of an electrically heated wire when moved through the air offers an attractive method of measuring wind velocities as soon as the laws connecting the wind velocity with the heat dissipation have been reduced to scientific and also to practically manageable form. The experimental discovery of the law was first published in the 1909 *Transactions* of the American Institute of Electrical Engineers by Messrs. Kennelly, Wright and Van Bylevelt. They found that, after allowing for a small constant loss of power in the stationary wire when the wind velocity was zero and also for a small but usually negligible radiation loss, the power convected from unit length of a wire, maintained electrically at constant temperature elevation, was proportional to the square root of the wind velocity; so that if the wind velocity quadrupled the watts per centimeter liberated from the wire at constant temperature would be doubled.

Professor Morris described various electrical arrangements for measuring the power dissipated from his hot test wire. He tried wires of iron, copper, nickel, tantalum, platinum and tungsten. Platinum was finally selected because of its constancy of surface condition. The preferred arrangement was a little Wheatstone bridge of four short wires, two of manganin and two of platinum, all exposed to the same wind velocity. The bridge would be initially balanced in stationary air with a current of say 1.5 amp. When exposed to the wind, the two fine platinum wires would cool off and change in resistance, whereas the two manganin wires would not have their resistance appreciably altered. This would cause a galvanometer in the bridge wire to show current and call for a readjustment of the balance. The current supplied to the bridge would have to be increased until the balance was restored, in which case the platinum wires would be brought back to their original temperature and the power dissipated from them would be proportional to the square of the current. The square of the power would then measure, within a small correction, the wind velocity.

The above method was also checked by the Pitot-tube method, and the results, in watts per linear centimeter, were in conformity with those presented in the A. I. E. E. paper above mentioned. There still remains a good deal of experimental work to be done before the fundamental mathematical formulas derived by Boussinesq in 1905 from hydrodynamical considerations can be submitted to full verification, since they involve various hydrodynamical factors, such as the density, thermal conductivity and specific heat of the surrounding gas the velocity of which is to be measured. Professor Morris points out that this method is capable of measuring wind velocities with considerable accuracy over a range from well under 1 mile per hour up to at least 40 miles per hour, with a conveniently portable set of apparatus. The practical value of such a hot-wire velocity gage, however, is yet to be demonstrated, because of the rapidly fluctuating or puffy character of winds in many instances. Each change in velocity requires a new setting of the instrument, thus rendering it somewhat clumsy to follow rapid variations and practically impossible to measure instantaneous velocities. A certain element of sluggishness is also present, due to the time lag between changes in the rate of heat convection from the wires and the corresponding changes in temperature.

MINIMIZING MOMENTARY LOAD FLUCTUATIONS ON FEEDERS.

With the continued increase in the size of the generating equipment of central stations, the necessity for limiting the load fluctuations on the station has become of less importance, and at the present date little discrimination is made in rates between fluctuating and constant loads, except as they may vary in load-factor or time of occurrence. For example, the railway load which was formerly considered undesirable for the central station is now looked upon as highly desirable from many points of view. On the other hand, conditions concerning voltage regulation on lighting feeders have not changed, and it is just as essential to-day as it ever was to limit the amount of fluctuating low-power-factor load on alternating-current lighting circuits. With the extension of alternating-current feeder circuits to outlying districts, which is one of the very prominent developments of the present, the subject of load fluctuation minimization becomes of increasing importance. Of the numerous energy-consuming devices perhaps the chief offender in respect to undesirable load fluctuation when uncontrolled is the alternating-current motor, the demand of which upon starting, even without load, may reach many times the full-load value. The excellent normal operating characteristics of the standard types of these machines are too well known to justify extended comment, but it seems well worth while to outline the methods employed to minimize their inevitable disadvantageous starting features, as has been done by Mr. William E. Kampf on page 877 of the present issue. In drawing conclusions from the test curves, sight should not be lost of the fact that the individual motors tested were not selected for comparative purposes, and therefore the relative performances of the different types cannot properly be determined by comparing one set of curves with another. However, the curves serve well their intended purpose of showing the relative performance of each type of machine when subjected to various methods for minimizing the starting current.

CONVENTION OF THE ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.

By Telegraph.

The fifth annual convention of the Association of Railway Electrical Engineers held its opening session on Oct. 22 in Chicago, the attendance being about 200. In his opening address President F. R. Frost of the Sante Fé Railway said that the recommendations of the association were being generally adopted, citing as illustrations the 60-volt system for head-end car lighting and specifications for incandescent car lighting, etc. Secretary J. A. Andreucetti, of the Chicago & Northwestern Railway, reported that the total membership of all classes at present is 489.

Committee reports were presented at both the morning and the afternoon session. The report on the wiring of various classes of railroad buildings was presented by Mr. A. J. Farrelly, of the Chicago & Northwestern Railway. Mr. E. W. Jansen, of the Illinois Central, presented a report on data and information; Mr. H. C. Meloy, of the Lake Erie, a report on improvements, and Mr. J. R. Sloan, of the Pennsylvania Railroad, a report on standard ball bearings for axle generators used in lighting. Following a discussion that embraced a wide range, all the reports mentioned were adopted as read except that on ball bearings, which was altered to include roller bearings of annular ball-bearing sizes. The subjects of electric drive in machine shops and round-house lighting received considerable attention. A conspicuous feature of the convention was a display of electrical appliances made by about forty exhibitors. The exhibits, as well as the entertainment features, were in charge of the Railway Electrical Supply Manufacturers' Association.

CENTRAL-STATION DEVELOPMENTS AT LOUISVILLE, KY.

In demurrers filed by the Kentucky Electric Company of Louisville, Ky., to the proceedings instituted in Judge Samuel Kirby's court by the city of Louisville, seeking to prevent the company from selling or attempting to sell its plant to H. M. Byllesby & Company of Chicago, who recently purchased the Louisville Gas Company and the Louisville Lighting Company, no statement was made to the court by the company as to whether it has sold or attempted to sell its properties to the Byllesby interests. The demurrers filed took exception to eight references to competition in the sale of electricity, as stated in the petition of the city.

In its demurrers the Kentucky Electric Company alleges that the petition of the municipal authorities fails to state sufficient facts to support action against it. The city has alleged that certain provisions of the company's franchises make it unlawful for the corporation to sell out to outside interests. In an amended petition the city made the Fidelity Trust Company and the Columbia Trust Company, of Louisville, co-defendants in the action instituted against the Kentucky Electric Company, on the ground that these financial institutions held the stock to be delivered to the Chicago capitalists.

It developed during the proceedings in court that President Robert E. Hughes, of the Kentucky Electric Company, is in receipt of a letter from the officers of the Louisville Lighting Company making plain the stand of that company. The letter is the result of charges published a short time ago by the Kentucky Electric Company to the effect that representatives of the Louisville Lighting Company were spreading the rumor that it, the Kentucky company, has sold out to the Byllesby company. It is said that the letter which President Hughes has received is not to be made public.

ELECTRICAL DEVELOPMENT SOCIETY ORGANIZATION DETAILS.

The third meeting of the committee which was appointed by members of the National Electrical Contractors' Association, the Electrical Supply Jobbers' Association and the National Electric Light Association and representatives of some of the electrical manufacturers at their convention at Association Island, Lake Ontario, on Sept. 3, for the purpose of organizing a co-operative society or association, with the object of developing the entire electrical industry and improving trade conditions within it, was held at the Engineering Societies Building, New York, on Oct. 18.

At the meeting of this committee on Oct. 3 it was planned to incorporate the new association under New York laws with the name "Society for Electrical Development," and as was mentioned in the *Electrical World* for Oct. 12, papers to this end were drawn up and submitted to attorneys for examination as to their legality. It had been hoped that the incorporation could be effected prior to the Oct. 18 meeting. This was not accomplished, however, as the attorneys called attention to the fact that the word "company" or "corporation" or "incorporated" must be embodied in the name of a corporation. At the Oct. 18 meeting the committee decided, therefore, to call the association "The Society for Electrical Development, Inc.," and the action on this point completes all the details necessary to the incorporation. The committee expects that this will be effected before the next meeting, which is scheduled for Nov. 18.

One of the most important results of the Oct. 18 meeting affects the operating control of the policies and work of the society. This was to the effect that the board of directors is to be composed of twenty members, to be divided into five classes. Four of the directors are to be chosen from the central-station interests, four from the contracting, four from the manufacturing and four from the jobbing interests, and four directors will be chosen at large. With the exception of the last-named four, who will be chosen by the membership of the society as a whole, the directors will be elected by the membership represented in the class which they are to represent. This method, the committee believes, will assure for all time an even balance among all the interests in the electrical industry in the operation of the society and will also assure fairness and equality to each interest.

Approval was given by the committee to the by-laws that had been drafted by a sub-committee in charge of that part of the work. These are not available for publication at this time, but some details of the financial plan provided by them have been learned. This plan, through which the funds to advance the purposes of the society will be obtained, provides for subscriptions by the various members on the following basis: Central-station and manufacturing members will subscribe respectively at the rate of not less than one-fifteenth of 1 per cent of the gross amount of their respective sales up to and including $20,000,000, and at the additional rate of not less than one-twentieth of 1 per cent on the gross amount of such sales in excess of $20,000,000. The contracting, dealing and jobbing members represented by membership in the society are to subscribe at the rate of not less than one-twentieth of 1 per cent of the gross amount of their respective sales.

In figuring out the foregoing schedule, the committee found that the interests with gross sales of more than $20,000,000 would not receive added benefit from the work of the society in proportion to the excess of their sales over $20,000,000, and therefore adopted for such members the scale of subscription which is noted above.

The committee also decided, as will be seen from the terms of the schedule, that there should be a differential between the subscriptions of the lighting and manufacturing interests and those of the jobbing, dealing and contracting interests. This decision was founded chiefly upon the

fact of the amount of local advertising and activity of the last-named interests as represented by co-operative newspaper pages and similar movements.

Committees were appointed to prepare plans for the detail work connected with the financing, the policy and the work to be done by the society. Approval of all of these plans and the election of directors, officers and an executive committee at the next meeting, on Nov. 18, will complete the organization details of the society, which will then be in a position to go ahead with its work.

PROPOSED NATIONAL COMMISSION TO SOLVE WATER-POWER PROBLEMS.

At the recent Chicago convention of the American Electric Railway Association a paper was read by Mr. James E. Hewes, of H. M. Byllesby & Company, on "Advantages to Communities Through the Development of Water-Powers," in which the concrete suggestion was put forth for a national commission of experts to solve waterway and water-power problems on a broad scale. In reference to this portion of his subject Mr. Hewes said:

"Our first duty in this matter is to see that honest business men and properly qualified engineers form a commission, properly paid for its services, to determine a broad plan for the development of river navigation and water-power, wherever power can be developed advantageously, and where a dam must be used for navigation.

"A dam used for navigation improvement is usually not the dam best adapted for power purposes, because the head is low, and if such a dam were used in power development high water would cause great fluctuations in capacity.

"In such problems the commission I have mentioned could determine if it is feasible to build a high dam instead of a low dam; also if the additional expense is warranted by the government, and if corporations would pay the additional expense due to the development of power.

"Such a commission would solve a problem that no one administration has yet solved. This is a problem that ought not to be an administrative problem. It is unfair to put the burden on an administration, but the administration that creates such a commission as I have outlined will have done the biggest thing yet done by any administration. A commission that would accomplish the control of floods in the Mississippi Valley and its tributaries and improve the navigation of the river would be doing a bigger thing for posterity than the digging of the Panama Canal or anything else that has ever been done by any single government for its people."

In his paper Mr. Hewes pointed out the enormous loss of life and property in the United States due to floods, and said that the first great benefit of water-power development is the prevention of floods. The present government policy, he declared, is "saving at the spigot and wasting at the bung-hole." The government should begin down-stream and work up. Continuing, he said: "The Mississippi Valley has many water-power sites where development would mean prevention of floods, cheap navigation and fair income to corporations that could be induced to co-operate with the government in the joint development of water-power and the improvement of navigation."

Every dam not used for the development of electrical energy means just so much loss of income to the community. At the present time "it is almost an insurmountable proposition to obtain government consent to build a dam, unless provision is made for navigation, such as the building of locks at rapids over which even an Indian has never paddled his canoe."

The economic importance of water-power development in saving coal was pointed out by Mr. Hewes. Thanks to high-potential electrical transmission, "I dare say it is possible to-day to cover the entire area of the United States with a network of high-tension lines connecting together, with efficient distribution, all of the water-powers capable of development in the United States."

Navigable waterways mean saving in transportation. "These are the big things which we should conserve to the people and hand down to posterity—navigable rivers, cheaper transportation and developed water-power, the coal remaining to heat the bodies of our descendants." The sun, in lifting water, is the greatest pumping plant in the universe, and the author believes that this is about the only way in which its rays can be used as a large source of power. It is the one great perpetual motion.

ANNUAL REPORT OF WESTERN UNION TELEGRAPH COMPANY.

The Western Union Telegraph Company in the year ended June 30, 1912, made substantial gains in its gross revenues, as compared with those in the preceding year. These gains were due largely to the introduction of new forms of telegraph and cable service, resulting in a wider utilization of its facilities in what had been comparatively idle periods in the past. During the year, moreover, the regular classes of service showed their normal increases, which indicates that the new services were not used as substitutes for the old. The statements of revenues and expenses for the past two years compare as shown in condensed form in Table I.

President Vail, in discussing the revenues, called attention to the gratifying increase of $6,182,637 in the telegraph and cable earnings over those in the previous year and to an increase in land line message tolls of $4,357,373, or 15.57 per cent. There was also a large increase in cable tolls, due in part to natural growth, but largely to the inclusion of the revenues of the Anglo-American Telegraph Company and the Direct United States Cable Company from June 1, 1912. Despite the gain in gross revenues, there was a decrease in net profits last year, as was the case in 1911. This amounted in the year ended June 30, 1912, to $181,386, or 2.5 per cent. Commenting further upon the income account, President Vail said that the salaries and wages account increased over that of the preceding year by $2,697,318, or 19.9 per cent, which includes payments to cable employees taken over from the Anglo-American and Direct cable companies. He added, however, that these figures were not out of proportion to the increase in gross revenue. There was also a decrease in income credits during the year as compared with those in 1911, amounting to $344,000. This decrease was due to a reduction in the amount of interest received from the American Telephone & Telegraph Company and to the fact that the Western Union received a stock dividend from one of its affiliated companies in the preceding year. The charges for repairs and reconstruction of land lines were $558,788 larger than those of the preceding year, owing to the policy of improving the plant and building up reserves for this purpose. The balance sheet as of June 30, 1912, is given in condensed form in Table II. In discussing this President Vail said that the company's plant, exclusive of ocean cables leased, was extended during the year by 1709 miles of poles, 21,115 miles of copper wire and 4857 miles of iron wire, making a total addition of 29,972 miles of wire. There were 25,392 Western Union offices on June 30. During the year the executive committee, after full consideration of the company's requirements for office space, authorized the construction of a thirty-story building on a plot 75 ft. by 77 ft. at 14 Dey Street, New York, and this building, it is expected, will be completed before Jan. 1, 1914. The board of directors, following a reference made in the preceding annual report to the desirability of pro-

viding an adequate depreciation fund out of earnings over and above the dividend then paid, until such time as the fund would admit of an increase in the dividend rate, voted to appropriate out of earnings in equal quarterly instalments during the year commencing with Jan. 1, 1912, the sum of $3,400,000 for repairs and maintenance, and also to appropriate the sum of $5,000,000 in such quarterly instalments as should be determined upon by it for reconstruction and depreciation reserve.

TABLE I.—INCOME ACCOUNT.

Year Ended—	June 30, 1912.		June 30, 1911.
Gross telegraph and cable earnings	$40,857,768.91		$34,714,810.07
Miscellaneous earnings	803,670.57		763,982.81
Total earnings	$41,661,439.48		$35,478,792.88
Deduct:			
Operating expenses, including rent of leased lines, reconstruction, repairs, miscellaneous interest, etc.	$35,350,422.30	$29,153,631.63	
Taxes	713,413.80	900,000.00	
	36,063,836.10		30,053,631.63
Balance	$5,597,603.38		$5,425,161.25
Add:			
Income from loans and investments, including rentals from real estate	1,326,367.67		1,680,196.23
Net profits	$6,923,971.05		$7,105,357.48
Deduct:			
Interest on bonds of Western Union Telegraph Company	$1,670,416.79	$1,733,389.52	
*Appropriation for reserves for repairs and reconstruction of land lines	1,250,000.00	.....	
Dividends	2,991,823.50	2,991,304.50	
	5,912,240.29		4,724,694.02
Balance transferred to surplus account	$1,011,730.76		$2,380,663.46

*This appropriation is in addition to the six months' appropriations from Jan. 1 to June 30, 1912.

As a result of a continuance of this plan the possibility of increase in the dividend rate for some time to come is, of course, precluded, but, as stated in the report, the property will be strengthened through this policy and future increases in dividends will be assured. Extensive comment was also made upon the desirability and the mutual advantages to both the public and the company of utilizing the facilities of the company during periods now idle, the effect of which would be the distribution of overhead charges through increased service and ultimate reduction of rates. The report also discussed the necessity, for securing the best service, of both physical connection and operation of cable and land lines under one central control, and then traced the history of the negotiations through which the Western Union Company established a common operating control for its lines and those of the Anglo-American and Direct cable companies.

TABLE II.—BALANCE SHEET AS OF JUNE 30, 1912.

Assets:	
Property account	$136,251,623.00
Other securities owned	19,569,290.78
Inventories of material and supplies	2,308,585.59
Current assets	9,359,492.87
Total	$167,524,992.24
Liabilities:	
Capital stock issued (less $30,341.04 held in treasury)	$99,786,758.96
Capital stock of subsidiary companies	3,893,375.00
Funded debt	32,602,000.00
Current liabilities	4,806,883.14
Deferred non-interest-bearing liabilities	12,385,763.19
Reserves	3,324,125.21
Surplus	10,726,086.74
Total	$167,524,992.24

There are six companies at this time owning transatlantic cables, as follows: The French company, with two cables, which is operated independently; the Commercial company, with six cables; the German company, with two cables, all of which are operated by the Mackay interests; the Anglo-American company, with five cables; the Direct United States Company, with one cable, and the American Telegraph & Cable Company, with two cables, all of which are operated by the Western Union company.

Considerable space was devoted in the report to the relations and the differences between the Western Union Telegraph Company and the American Telephone & Telegraph Company, the relations being based primarily upon the complementary character of the two services, as exemplified in the use of the telephone for the collection and delivery of telegraph messages, the opportunity for the joint use of plant and the avoidance of economic waste, while the differences are in the characteristics of the two classes of service rendered, one, the telephone, requiring immediate service and sufficient equipment and organization to meet the maximum demand at all times, resulting in uneven load upon the system and operators, while the other, the telegraph service, inasmuch as messages may be deferred, requires equipment and organization only for the needs of the full-load messages which must be immediately dispatched to their destination.

EXPANSION OF THE NARRAGANSETT ELECTRIC LIGHTING COMPANY.

Rapid expansion is taking place in the industrial uses for electrical energy in the district served by the Narragansett Electric Lighting Company, which includes the city of Providence, R. I., and surrounding territory. The company is now installing in its main generating station at Providence an additional 9000-kw turbo-generator of the horizontal Westinghouse-Parsons type, for 60-cycle, three-phase, 11,000-volt service. The system load for the week ending Oct. 5 was 27 per cent larger than the load for the corresponding week of 1911. The new unit will probably be placed in service about the middle of November. The Narragansett company has recently taken over the Narragansett Pier Electric Light & Power Company, having a capitalization of $100,000 and an outstanding bond issue of $55,000. The latter company serves Narragansett Pier, Peacedale and Wakefield. A 33,000-volt, three-phase, 60-cycle transmission line is under construction from Providence to Narragansett Pier and Wakefield over private right-of-way, the total distance being 35 miles. The line will carry two three-phase circuits, each of 5000-kw capacity. Both line and station equipment is being installed in complete duplicate, providing a high degree of security from service interruptions.

The Narragansett company has recently closed a twenty-year contract with the New York, New Haven & Hartford Railroad Company to furnish electrical energy for operating the trolley system from Providence to Narragansett Pier, a distance of 35 miles. Under this contract the company will also furnish energy for operating the Kingston branch of the New Haven road after the work of electrification has been completed. The many industries situated in Providence and vicinity offer an unusual opportunity for securing large motor-service contracts, and the company is conducting a very successful campaign for this class of business, a number of large contracts having recently been closed.

Mr. Arthur B. Lisle is the general manager of the Narragansett Electric Lighting Company, and Mr. E. R. Davenport is the sales manager.

KANSAS UTILITIES CONVENTION.

Nearly 100 electrical men attended the fourteenth annual convention of the Kansas Gas, Water, Electric Light & Street Railway Association at Manhattan, Kan., Oct. 17 and 18. Opening Thursday afternoon's session, President B. F. Eyer introduced Mayor S. F. Goheen of Manhattan, whose welcome was responded to by Mr. L. O. Ripley, Wichita.

Following with his presidential address, Professor Eyer spoke of the recent rapid growth of the industry resulting from the pioneering efforts of its founders and inventors. As an advocate of centralized energy generation and distribution, he told of the struggle for existence which a multiplicity of small competing plants will surely mean for each. Expenses can be reduced, he said, both by stopping wastes and increasing output. With the logical limit of the first approaching attainment, attention must now be turned to getting greater volume of business. The "new-business idea," while comparatively new in Kansas, has already, he said, proved itself a good investment in many small plants of the State. In closing, the president commended the intelligent and just regulation of utilities by a commission, as being wholly fair to both corporations and public.

INTERURBANS AND COMMUNITY DEVELOPMENT.

"The Relation of Interurbans to Community Development," a paper by Mr. W. A. Scothorn, Hutchinson, Kan., pointed out the benefits conferred upon both town and country by frequent and rapid interurban service, which through its convenience and cleanliness had now become a serious competitor of steam-railroad operation. Suburban territories are developed for homes of town and city workers, while the farmer and his family are in turn afforded the cultural advantages of closely populated communities. Often interurban lines also make available electric service for lighting farmhouses and doing much of the labor of the farm. With rapid delivery service the producer is able to distribute his products to better advantage. By adding to the attractiveness of farm life and reversing the tide from country to city, interurbans will increase the producing class, predicted Mr. Scothorn, and thus reduce the cost of living. He recommended the use of best standard track construction or private rights-of-way, and urged that the Kansas people recognize the possibilities in developing their own State instead of purchasing, from sharp land dealers at inflated prices, doubtful farm lands in distant sections of the country. In all rural development, he added, the presence of interurban railways always enhances values and plays a most important part.

Mr. L. O. Ripley, Wichita, reported the rapid suburban development that has followed construction of the Wichita-Newton interurban railway, which is now lined with truck farms and suburban tracts. The future development of the State, declared this speaker, depends largely upon the development of electric-railway lines.

BOILER-PLANT PRACTICE.

"Economic Methods of Coal Combustion" were discussed by Dean E. B. McCormick, of the Kansas State Agricultural College, Manhattan. Hand-firing furnace efficiencies, he said, are limited by the skill and willingness of the fireman, by the necessity of opening doors, admitting drafts which chill the fire, and by those furnace dimensions dependent upon the length and strength of the human arm. Even for hand-fired boilers the dean recommended larger clearances, approaching those used in mechanical stoker installations, thus permitting better combustion. He cited gains of 10 per cent in economy merely by raising the boilers or installing baffles to redirect the gases. In another case, he said, a boiler's rating was practically doubled by installing a mechanical stoker. Future advances in steam-generating economy, he predicted, will come from furnace rather than boiler improvements.

Mr. W. E. Sweezey, Junction City, expressed doubt whether in a small plant the gain effected by stokers might not be offset by the power required to operate them. Mr. Scothorn reported evaporating 7 lb. of water per lb. of coal without economizers, and even higher rates with special equipment. Superheated steam, he declared, renders the lubrication of engines difficult, although, of course, this objection does not hold for turbine operation. Mr. F. N. Jewett, St. Louis, testifying from his own operating experience, declared that in small plants equipped with two or three boilers the expenses of maintenance and upkeep on mechanical stokers will often go far to offset the gains in efficiency attained. It pays, however, he said, to hire skilful firemen. A plant test with identical boilers, coal, load, etc., showed that one fireman was burning $5 worth of coal more per day than did a second skilled man who received $1 per day higher wages. Here an apparent saving of $1 per day was really entailing a loss of $4. Mr. W. F. Fellows, Leavenworth, also testified that mechanical stoking is likely to effect little or no saving in small stations, where upkeep offsets possible economies outright.

CENTRAL-STATION ENERGY FOR FACTORIES.

Modern industrial processes are most advantageously carried on by specialized producers, said Mr. Gordon Weaver, Kansas City, and this general axiom applies pointedly to central-station service compared with isolated-plant operation. The company which makes a business of power production can furnish better and cheaper service than can the manufacturer who runs his plant as a side line. Large motor installations have correspondingly low billing and customer costs per kilowatt-hour, a factor sometimes overlooked when figuring motor-service schedules. If the average manufacturer will apply his isolated-plant investment to increasing his own special manufacturing facilities, said Mr. Weaver, he can make from 10 to 90 per cent more than by attempting private-plant operation. The usual "steam-heat" argument for installing a building or factory electric plant Mr. Weaver claimed to be a fallacy, since the demands of heating and electrical systems are largely divergent. In closing, the speaker recommended careful study of the prospective customers' private-plant costs, which are usually underestimated, as well as close consideration of the company's own rates in order that they shall be profitable for such large, long-hour business.

PUMP SLIPPAGE.

"Pump Slippage," a paper by Mr. J. W. Heck, Arkansas City, related to leakage losses around valves of reciprocating units employed for water-supply purposes and described an improved poppet-valve designed to minimize this slippage.

WOOD PRESERVATION.

Mr. W. W. Gerhart spoke of the germicide action necessary to wood preservation. In one instance he quoted ties treated with a creosote oil at 20 cents each are still intact after five years, while the untreated ties alongside have had to be replaced. Preservation is here saving $1 per mile per day. If proper temperature control is maintained and reasonable care taken, heat treatment will neither kill the wood fiber nor decrease the holding power of spikes. Mr. C. L. Brown, Abilene, and Mr. H. H. Sparks, Kansas City, also spoke briefly.

DEPRECIATION IN ELECTRICAL PROPERTIES.

Prof. George Shaad, head of the electrical department of the University of Kansas, Lawrence, followed with a clear exposition of the principles of fixing upon depreciation, or the lessened physical or utility value of equipment. The speaker pointed out that there can be no depreciation below scrap or second-hand value, explaining also that authorities are not agreed upon the length of life of various classes of utility property. A straight-line rate of deprecia-

tion is, however, found by dividing known service value by the assumed life. The Wisconsin commission has allowed eighteen to twenty years as the composite life of electric-light plants. In street-car systems, where equipment is continuously being added and withdrawn from service, the "present" value is assumed to be 50 per cent of the total cost value. Rates of depreciation allowed by authorities have ranged from 2 per cent on underground conduit to 12 per cent on coal-handling machinery. Minimum values permitted of equipment in service range from poles at 25 per cent to switchboard meters at 80 per cent. Rates of depreciation are, after all, fixed by local conditions and any abnormal depreciation factor constitutes an inherent risk and should be compensated for accordingly.

Mr. L. O. Ripley, Wichita, advised technical men to devote closer attention to the financial end of operating. Mr. L. K. Greene, Concordia, quoted the Kansas commission as approving a 10 per cent reduction for depreciation in making out tax-report valuations. Mr. Marsh, Garden City, urged upon the association the injustice done by the state commission in allowing his plant only 4 per cent on its reproduction value, or a profit of less than 1 per cent. With a book value of $61,000, the engineer's appraisal was fixed at $45,000 with a recommendation for 6 per cent. The commission disregarded this advice and itself fixed 4 per cent. It has also limited motor-service rates to 6.5 and 4.5 cents, making no allowance for horse-power connected. Mr. F. F. Rossman, Kansas City, illustrated with an anecdote the plight of a plant in which all the original equipment has been replaced during the maintenance process.

THERMAL INSULATION.

"Insulation for Heat and Cold" was the topic of a paper by Mr. H. W. Prentiss describing thermal non-conducting coverings manufactured by the Pittsburgh Cork Company, Pittsburgh. The speaker also explained methods of testing for condensation losses and calculated the wastes involved.

STORAGE BATTERIES FOR SMALL PLANTS.

"Storage Batteries for Small Central Stations," a paper by Mr. H. B. Marshall, Electric Storage Battery Company, St. Louis, Mo., outlined the advantages of direct-current generation with storage-battery auxiliary for towns of 1000 or less, where twenty-four-hour service is desired. With modern internal-combustion engines and high efficiency lamps, this method has become commercially profitable, said Mr. Marshall. The engine set is run a few hours daily at full load and the battery charge depended upon for the rest of the twenty-four. Fifteen such plants are now in use in Nebraska, and there is one at Perry, Kan. Battery renewals, said the speaker, can be fully covered by a 6 per cent maintenance allowance. In reply to a question, Mr. Marshall frankly stated such auxiliary use of a battery to be out of the question on an alternating-current system.

President H. J. Waters, of the Kansas State Agricultural College, opened Friday afternoon's program with an engaging discussion of present high cost of living, tracing it to the large production of gold, unbalancing of the food-producing and consuming classes, too many middlemen, and the extensive and unnecessary transportation of commodities.

STEAM HEATING FOR CENTRAL STATIONS.

In a paper on "Steam Heating for Central Stations" Mr. H. C. Kimbrough, American District Steam Company, Chicago, Ill., declared that a utility's service to its customers is not complete unless it furnishes heat as well as energy for lamps and motors. Steam heating, he said, is one of the most profitable of all utilities. Instances when it has failed to pay are traceable to (1) too low rate for steam, to build up electric load; (2) consumer's regulation of his own installation, which the company should specify, or (3) poor management.

NEW APPARATUS.

Mr. J. L. Buchanan, General Electric Company, Chicago, presented an illustrated paper on new types of transformers, lightning arresters and ozonators.

Mr. L. A. S. Wood, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., followed with a discussion of "Arc Lamps and Their Recent Developments," describing flame-arc and metallic-flame units.

Mr. S. F. Dibble, General Electric Company, Chicago, exhibited a number of lantern slides showing motor applications. The speaker also discussed trade relations between manufacturer, dealer and central station, advising that prices be maintained as a matter of justice to all. Price cutting, he said, always brings retaliation, and quality soon suffers.

Mr. F. N. Jewett, Wagner Electric Manufacturing Company, St. Louis, Mo., described some new alternating-current devices developed by his company, mentioning particularly the unity power-factor motor, 60-cycle rotary converters in 1-kw to 5-kw sizes for vehicle charging, lantern operation, X-ray machines, etc., and mechanical rectifiers for ignition-battery charging.

OFFICE ORGANIZATION.

Mr. I. F. Thomas, Wichita, Kan., in his paper on "Office Organization," recommended proper division of work and responsibility to avoid overtime as far as possible. He also advocated the English system of periodical inspections by certified public accountants. This plan, he thinks, encourages the employees if all is found correct and invariably pleases the stockholders. The speaker urged that more time be given to checking, since by calling off postings in advance time in hunting errors can frequently be saved at the end of the month. A weekly or occasional meeting of the business staff at which suggestions are invited, to be tried out and adopted if approved, will also stimulate the interest of the rising men. In closing, Mr. Thomas declared that no system of accounts is a good one unless two different individuals can be held responsible for all items.

RURAL TRANSMISSION LINES.

Mr. L. K. Greene, Concordia, next described his transmission system, which serves a group of small towns and the included rural districts. Twenty-four-hour service is given, except on Sunday, when the plant runs from 7 p. m. to 5 a. m. In hot weather, however, the plant is operated for fan use. Mr. Greene does not favor building rural lines unless there is a town of at least 500 inhabitants as an objective. He recommends furnishing service to farmers in groups of two or more from his 13,000-volt transmission, the farmers prorating the cost of high-tension transformers and 2300-volt primary distributions, and each paying for his own 2300/110-volt transformer. The company supplies the meter and charges $2 minimum monthly and 12 cents per kw-hr. The latter is the regular town schedule, where the minimum is $1. Energy is wholesaled to local distribution companies for 5 and 6 cents per kw-hr. at their own switchboards, the purchaser company building and maintaining 10 miles of the line. Mr. Greene uses 30-ft. poles with 6-in. tops, set forty to the mile. Six miles is of No. 4 copper, 48 miles of No. 6, and 1 mile of No. 9 iron wire. The line cost $500 a mile.

In the discussion which followed Mr. L. A. Pettit, Jr., Emporia, observed that small communities usually produce a greater revenue per capita than do large cities. Mr. Greene reported Concordia, with 6000 population, to have $4.25 income per capita. Mr. W. A. Scothorn, Hutchinson, declared that, regardless of the rate used, the income per capita will usually be found to remain constant at about $4. He advocated selling large quantities of cheap energy. Mr. J. F. Vail, Manhattan, said that a plant not producing $6 per capita he deemed "not worked up at all." Mr. W. C.

Duncan, Lawrence, urged that "new-business" methods be applied to acquiring load in Kansas as elsewhere. "The sales department," he said, "is the goose that lays the golden eggs."

Mr. F. H. Hanson, engineer for the Kansas Public Utilities Commission, Topeka, spoke of the value of a complete system of plant records and the necessity of maintaining entries. It is the prosperous plants, he noticed, which keep records carefully. Usefulness, of course, should always determine the items to be recorded, the smaller plants requiring simpler systems. Supervision of accounts and regulation of properties by utility commissions, said Mr. Hanson, will benefit plant owners, operators, customers and the public in general. He described systems of pole records, etc., used in Milwaukee, Madison and Cleveland, and quoted from the *Electrical World* an account of the system at Worcester, Mass. The subject was discussed briefly by Messrs. Sweezey, Thomas and Scothorn.

FIRELESS COOKERS AS DAY-LOAD BUILDERS.

Mr. W. C. Duncan, Lawrence, read a paper on "The Electric Fireless Cooker as a Day-Load Builder," in which he had the collaboration of Mr. C. A. Bergen, Emporia. After a historical sketch, the authors pointed out the advantages of a cooker with automatic clock cut-off, insuring against waste or burn-out. Home tests preparing dishes for a family of five showed the watt-hour consumption of certain foods to be as follows: Roast beef, 400; cabbage, 280; ham, 250; rice pudding, 280; oatmeal, 250. The monthly consumption for a family of three using the cooker exclusively was 30 kw-hr; for five, 40 kw-hr., and for two, using cooker and toaster stove, 30 kw-hr.

NOTES ON OTHER PAPERS.

Mr. R. K. McMasters, Kansas City, read a paper on "Some Notes on the Economical Design of Distribution Systems," showing methods for calculating the primary and secondary drop to be obtained and presenting formulas for the computation of feeder-point locations, line problems, etc.

Prof. P. F. Walker, Kansas University, Lawrence, discussed "The Natural Gas Situation" and "Gas-Meter Peculiarities."

Mr. F. F. Rossman, Kansas City, read a paper on "Synchronous Motors for Power-Factor Connection," prepared

PRESIDENT-ELECT L. O. RIPLEY.

by Mr. N. Stahl, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Mr. M. B. Cooper, Cleveland, presented a paper by Mr. R. E. Campbell, National Quality Lamp Division, Cleveland, Ohio, on "The Proper Lamp for a Circuit."

Mr. F. B. Uhrig, Western Electric Company, Kansas City, delivered an illustrated lecture on the production of copper cable from mine to finished reel.

ELECTION OF OFFICERS.

On motion of the nominating committee, the following officers were elected unanimously: President, L. O. Ripley, Emporia; vice-presidents, A. L. Newman, Arkansas City; J. H. Rothert, Junction City, and A. H. Purdy, Topeka; secretary-treasurer, W. H. Fellows, Leavenworth.

Executive committee—B. F. Eyer, Manhattan; W. Patton, Topeka; C. L. Brown, Abilene; J. D. Nicholson, Newton; W. E. Sweezey, Junction City.

Nominating committee—W. A. Scothorn, Hutchinson; M. T. Flynn, Kansas City; William Hands, Kansas City.

Place of meeting—A. W. Newman, Arkansas City; H. W. McGruder, Liberal; C. L. Brown, Abilene.

Auditing—C. H. Talmadge, Kansas City; C. H. Rothert, Junction City; C. M. Lewis, Kansas City.

Resolutions—H. S. Sladen, Wichita; A. H. Purdy, Topeka; L. K. Greene, Concordia.

President-elect Ripley is vice-president and general manager of the Kansas Gas & Electric Company, which serves Wichita and Newton.

On Friday morning automobiles took the delegates on a 6-mile ride to the hydroelectric plant of the Rocky Ford Power Company, where they were the guests of Dr. C. K. Raber, president of the company. Returning, they visited and inspected the grounds of the Kansas State Agricultural College, attended chapel exercises and were served with luncheon by the young women of the advanced domestic-science classes.

NEW ENGLAND SECTION, N. E. L. A., CONVENTION.

The fourth annual convention of the New England Section of the National Electric Light Association was held at Paul Revere Hall, Mechanics' Building, Boston, Mass., on Oct. 15 to Oct. 17. An account of the opening session was given on page 812 of last week's issue. Certain of the papers presented during Oct. 16 and 17, together with the discussions, are outlined below.

THE RELATION OF THE CENTRAL STATION TO THE PROSPECTIVE CONSUMER.

Under the above title, Mr. E. M. Addis, manager of the Twin State Gas & Electric Company, Brattleboro, Vt., presented a vigorous criticism of the policies of any electric lighting company which fails to appreciate the viewpoint of its customers and the public in the territory served by its system. The author pointed out that the policy of any company is a direct reflection of the manager's attitude toward the public, and illustrated the work of a representative forenoon in the office of a manager indifferent to the welfare of his patrons and failing to realize the importance of protecting customers against overcharges and insisting upon straightforward dealings at all times. By granting every customer a thorough hearing, making full investigation and adding an honest explanation, the good will of the patrons may be easily maintained. Much may also be accomplished by the use of descriptive literature, advertising, solicitors and free trials of energy-consuming devices. Mr. Addis made a strong plea for the practice of wiring houses and mercantile establishments by central stations and urged that the prices for such work by contractors might be reduced if the latter would not be above putting on overalls and jumpers on occasion and pushing a wiring job along toward quicker completion.

Discussion.

Mr. E. R. Davenport, Providence, R. I., took issue with the author's hypothesis of stating in advance the approximate cost of a wiring installation for a prospective customer and making the latter think that a given price would not

be exceeded where the work is done by a contractor. He asked how many central stations had ironclad agreements with contractors in their territory and maintained a skeptical attitude regarding the fear of the latter by the former. He favored co-operation in prices between the central station and the contractor and contended that the tactless type of manager assumed by the author represents an extreme case. The tendency of the times is for the central station to co-operate more and more with electrical supply dealers, and the speaker said that in his opinion the time would come when all apparatus would be purchased outside the central station, leaving the latter to specialize exclusively in the sale of electrical energy. Mr. Davenport said that, in proportion to the size of the city, the Narragansett Electric Lighting Company, of Providence, had added more sockets to its system in the past year than the New York Edison Company. More than 84 per cent of the buildings in the Providence company's territory are wired for electric service. He commended the organization of the New England Electric Development Association as an illustration of a modern co-operative movement between central-station and contracting interests. Closing, he said that far more than 25 per cent of the prospective customers solicited in Providence become actual customers.

Mr. Levin J. Chase, Concord, N. H., pointed out some of the special qualifications of the successful manager, emphasizing good citizenship, interest in human affairs, common sense, willingness to assist the customer in dealing with difficult problems relative to the use of electric service under his particular conditions, and the value of good service to customer and company alike. The ability to take the customer's point of view and to stimulate a desire for service, without undue haste or pressure, was also shown to be important. Mr. Chase contended that electric service would sell itself if the customer realized even half its advantages. A friendly interest in the customer is most desirable, while personal attention to his requirements counts heavily in the company's favor. Wrangling over petty details makes enemies. The manager should "get out into the game" and take a live interest in what is going on in the community. Even a speech on socialism made by the speaker on the previous evening at a stonecutters' meeting resulted in the securing of a new house-wiring order. In conclusion, Mr. Chase called attention to the wisdom of slightly overestimating the cost of wiring in dealing with a prospective customer, who is thereby pleased when the actual bill for work done is less than the estimate.

Mr. H. T. Sands, Boston, Mass., disagreed with the author in regard to relations with wiring contractors, as advocated. Like the man in the prayer-meeting, the speaker had "seen a light" and believed that the central-station manager should be able to take "kicks" and still continue to smile. This is easy when it is learned. No matter how serious the breach between the public and the company may have been, it is the duty of the progressive manager to heal it. The author's picture of a saturated field marks a Utopian condition which is seldom realized. Mr. Sands made a vigorous speech in behalf of the policy of charging enough for wiring and apparatus to insure a fair profit to whoever does the work and contended that co-operation with local contracting interests is absolutely necessary to success. In many cases the contractor has received his training largely at the hands of the central station, beginning as a wireman on inside jobs and later entering business for himself. Any policy which results in the underbidding of the contractor by the central station makes it necessary in the long run for the contractor to charge higher prices for work which he actually secures. The speaker argued that overhead charges should be taken strictly into account in making up cost estimates on wiring jobs, deprecating the author's criticism that too much weight was given to these by contractors. Citing the benefits of co-operation, Mr. Sands called attention to the case of a company which turned the agency for a certain make of motors over to a local contractor, with the result that in a year 700 hp of new motor drives were connected to the system through the efforts of the latter.

Mr. A. S. Nichols, Woonsocket, R. I., recommended the elimination of the money deposit in connection with requests for new service. Only 0.5 per cent of his company's gross earnings are lost in bad bills. The deposit system causes unfriendly feelings on the part of the customer and is a relic of the days of gas lighting. The friendly wiring contractor is an unpaid agent for the extension of the company's service. The Woonsocket company considers interior wiring a transaction between the customer and the contractor, but it closely follows such work when under way and promptly calls a halt upon any tendency toward excessive charges. In case these are continued, the result is a loss of work to the contractor. Local relations are of the best in this field, and the company believes that the contractors wire installations as cheaply as would be possible if the central station undertook the work. At Woonsocket customers are not taken because they happen to be friends of the manager, but because of a genuine desire for electric service.

Mr. J. A. Fleet, Portland, Me., cited the friendly relations existing in his territory between contractors and the central station, and also urged the importance of taking overhead charges into account in estimates of wiring prices. Daily visits of contractors to the company's office are encouraged and looked into if omitted. A local agreement among contractors has done much to standardize the prices of work in the city.

Mr. W. S. Wyman, Augusta, Me., emphasized the need of proper treatment of old customers and contended that the successful manager should plan for satisfying these first, as the pleased patron is the best advertisement. The object should be to create and maintain a desire for electrical service at a fair price.

Mr. C. R. Hayes, Fitchburg, Mass., urged charging an adequate price for wiring, regardless of who does the work. He favored the extensive use of advertising in appealing to prospective customers. Mr. Frederick Prince, Hartford, Conn., cited successful conferences between the local central station and contractors in relation to new work. An inspection department is maintained by the company to follow the work of contractors and insure the utmost possible co-operation, including the laying out of switchboards, selection of motor sizes and choice of meters.

Mr. Eugene Carpenter, Oak Bluffs, Mass., brought out the point that the methods emphasized by the author were unquestionably correct under such conditions as exist in many small municipalities. He favored handling wiring and apparatus sales at a reasonable profit, and urged co-operation with contractors, notably along the line of supplying them with lamps at lower prices than might otherwise be obtained.

CO-OPERATION OF CENTRAL STATIONS AND MOTOR MANUFACTURERS.

The above paper, by Mr. J. M. Tomb, Westinghouse Electric & Manufacturing Company, Boston, Mass., emphasized the rapid growth of industrial electric power in recent years and called attention to the national publicity campaigns conducted by motor manufacturers in popular periodicals. The use of standard motors so far as possible was recommended as insuring lower cost of application to the central station. Twenty per cent of the industrial establishments in the country are electrically operated, and the future is filled with opportunity for such work. The author favored submitting a condensed report to each prospective motor user, stating the conditions of the industry in question, labor requirements, connected load, maximum demand, energy consumption per unit of product and other details in parallel installations which will help the customer to select

the electric drive. He stated that the cost of electric energy in most industries is but 1.5 to 3 per cent of the total cost of the product, while the cost of lighting is under 1 per cent. If through suitable "application" engineering the arrangement of machinery and the routing of material, or a special motor application to a loom, spinning frame, paper or rubber calender, should produce an increased output of 8 to 10 per cent, the customer could well afford to pay double the cost of producing power under existing conditions. Motor service engineers have done much to reduce the cost of production of many lines of merchandise through their analytical studies. Co-operative work is of vital importance in this field.

Discussion.

Mr. S. Fred Smith, Salem, Mass., advocated separating motor-service solicitation from lighting work and recommended visits of solicitors to motor manufactories. Such men should be posted on every plant in their territory. The electric-vehicle field is a valuable one for development. Mr. C. B. Burleigh, Boston, advocated looking beyond the price per kilowatt-hour in taking a broad view of motor-drive economics and realizing the benefits of electricity in forcing production. In dealing with costly products a slight gain in production through the use of the motor drive means large financial return.

Mr. St. John Morgan, Boston, called attention to the opportunities for efficiency engineers in connection with electric driving. The uniform speed insured by the electric drive is of great value, plants with mechanical drive sometimes showing speed fluctuations of 24 per cent instead of a constant speed as required under the conditions of manufacture. Mr. J. A. Fleet, Portland, Me.; Mr. D. S. Boyden, Boston; Mr. J. T. Day, Malden, Mass., and Mr. W. R. Eaton, Cambridge, Mass., also spoke briefly. The point was made that careful motor-service engineering tends to decrease the sizes needed in specific installations. Mr. Eaton said that a tabulation of motor customers whose installations ranged from 1 hp to 2000 hp in rating showed that out of 323 cases 78 per cent were using energy for less than two hours per day. In 50 per cent of these instances the power-factor was too low on account of the underloading of motors installed before the days of co-operation between motor manufacturers and the central station. The rate of production was increased in a printing plant by sixty impressions an hour by a change from isolated-plant to central-station service. In another case a gas-engine maker adopted the electric drive in his manufacturing establishment in order to secure the improved speed regulation associated with electricity.

A paper by Mr. C. H. Miles on "Application of Electricity in Agriculture" and one by Mr. Ralph Beman on "Illuminating Engineering for Central-Station Salesmen" will be abstracted in a later issue.

BANQUET.

The final event of the convention was a banquet held on Thursday evening at the new Copley Plaza Hotel, Boston, about 250 members and guests, including many ladies, being present. The gathering took place in the ballroom of the hotel and music by a twelve-piece orchestra with popular songs enlivened the courses. At the conclusion of the dinner President Whitaker introduced President Frank M. Tait of the national organization, who delivered an address overflowing with enthusiasm for the future of the central-station industry. Mr. Tait paid a high tribute to the inspiration furnished by women in the development of central-station service and business and outlined the recent celebration of the thirtieth anniversary of the establishment of service by the New York Edison Company, speaking in a congratulatory vein, with particular reference to the reliability record of that organization. The speaker said that the central-station industry as yet knows no such thing as a saturated field of electrical applications, the possibilities of the future being enormous. Anyone can enter this field and go as far as his personal limitations permit. The industry is calling loudly for the man of brilliant attainments, for it comprises within its scope the greatest business the world has ever seen. Closing, he spoke enthusiastically of the Boston 1912 Electric Show and highly complimented the Boston Edison company on its energy, alertness and resourcefulness, which had made such an exhibition a reality. The fact that such a section convention could be held between the show on the one hand and the baseball championship series on the other marked in a telling manner the loyalty of the New England Section's following. The executive committee has decided to hold the 1913 convention of the national organization in Chicago, and President Tait extended a cordial invitation to all to attend this, emphasizing the excellent committee work already under way and the prospects of unusually important and interesting reports and papers.

Mr. T. Commerford Martin, executive secretary of the association, spoke in a witty vein, touching upon the debt of the industry to the fair sex and upon the transformation of sedate Boston caused by the baseball triumph, and then, in a more serious mood, he paid an eloquent tribute to New England's electrical pioneers, sketching in bold strokes the influence of Franklin, Bell, Edison and Thomson upon the electrical art. He called attention to Boston's great part in the development of the copper industry and recalled some humorous early reminiscences of the Boston Edison system. Mr. Martin praised the Boston 1912 Electric Show in glowing terms and paid his personal respects to President Edgar of the Boston Edison company as one of the great leaders of the industry. "The association is trying to breed such men," said the speaker, "and in the formation and conduct of company sections lies a wonderful educational opportunity which is yet but little realized in New England." Closing, Mr. Martin pointed out that during his secretaryship the membership of the association has risen from 3000 to nearly 13,000 and said that the organization is the largest aggregation of engineering talent in the world, whether expressed in numbers, influence or opportunities. To cite a single instance of the association's beneficent activity, he said that the resuscitation chart and booklet issued by the organization have been adopted by the United States government and will be carried to every quarter of the globe on naval vessels.

The last speaker, Mr. Levin J. Chase, Concord, N. H., read a telling paper upon the human side of central-station management, under the title "Readiness to Serve." The author pointed out that electricity is rapidly becoming the mainspring of civilization and reviewed in straightforward fashion the value of courtesy, good temper, diligence, charity in thought and action, optimism, fairness, humility, willingness to learn from others and co-operation with employees. "The man with a pull cannot compete with the man who pulls," said the speaker. Harmony of aims and considerate treatment are essential to permanent success in dealing with employees and the public.

OFFICERS FOR ENSUING YEAR.

These officers were elected for the coming year: President, Mr. A. F. Townsend, Woonsocket, R. I.; vice-president, Mr. C. C. Wells, Middlebury, Vt.; treasurer, Mr. R. W. Rollins, Worcester, Mass.; secretary, Miss O. A. Bursiel, Boston. Executive committee—Messrs, H. B. Ivers, Portland, Me.; L. J. Chase, Concord, N. H.; L. D. Gibbs, Boston; E. A. Barrows, Providence, R. I.; B. H. Gardner, Waterbury, Conn., and J. S. Whitaker, Portsmouth, N. H. President-elect Townsend is manager of the Woonsocket Electric Machine & Power Company. Mr. George C. Ewing was chairman of the hotel committee and Mr. R. W. Rollins was chairman of the entertainment committee, which provided a dancing party, theater party and automobile rides for ladies and guests. The total registration was 650.

THE APPRAISAL OF INTANGIBLE VALUES IN PUBLIC UTILITIES.

Few questions connected with the valuation of public-service corporations are receiving more attention at the moment than the appraisal of the so-called intangible elements not entering into physical property, such as franchises, development costs, discount on securities and going-concern value. At the annual convention of the Northwest Electric Light and Power Association held last month in Portland, Ore., Mr. William J. Hagenah, statistician, Chicago, Ill., read a paper on this subject which is of considerable interest. This was briefly referred to on page 647 of our issue of Sept. 28.

After reviewing the history of the movement for regulation of public utilities and discussing some of the leading decisions handed down by our courts and commissions, the author dwelt at some length on the evils of competition in the public-utility industries, which, he concluded, not only cause a great increase in the fixed charges through the duplication of investment but greatly interfere with sound regulation by public-utility authorities on the comprehensive scale which is necessary in order to make it most successful. On this subject Mr. Hagenah said:

"An analysis of the construction account of nearly every large electric utility company further shows very heavy losses due to the policy of cities in fostering competition. Franchises have often been granted to separate companies to construct competing plants in cities where the total available service was not more than could be supplied by a single plant. Under such franchises a great duplication of property has occurred. A number of cities of less than 500,000 population have had as many as five or six independent competing companies at one time, with much of the property duplicated, all in opposition to the factor of diversity which makes central-station service profitable. A very large over-investment was made in good faith during this transition period. These franchises entirely ignored the uncontrovertible fact that utilities are natural monopolies, and that to authorize additional companies for the purpose of creating or continuing competition only creates economic waste. A lighting company is not governed by the laws and influences which apply to competing industries generally. Competition may be a factor in the development and regulation of private business, but it is an undeniable conclusion of our municipal history that every attempt to compel competition in public service has terminated in open or secret combination. Intelligent regulation of public utilities is predicated upon the well-established economic law that a regulated monopoly is capable of more economical operation, of rendering superior service, and of ultimately existing under a lower schedule of rates, than is possible under a condition of enforced or tolerated competition leading only to the duplication of facilities and the consequent waste of capital. An electric utility existing in any city under highly competitive conditions reflects an adherence to an erroneous public policy. Where consolidations have occurred they have necessitated the abandonment of some lines, the reconstruction of other lines and a general improvement of the service through the co-operation of all portions of the enlarged system with a diversified load and a centralization of management. In the organization of such a single company distinct public benefits are accomplished, the duplication of investment and operating expenditures is discontinued, lines are extended under a uniform policy conforming with a city's growth, but the greatest benefit results from the facility for comprehensive public regulation which the reorganization presents.

"It is impossible to study the construction and operating accounts of a lighting system during the years of competitive conditions without realizing the heavy burden of expense created by this policy. As a matter of self-preservation it was often necessary for a company to purchase the property of a rival, and in doing so it often acquired equipment for which there was no real demand. Even in cities of less than 50,000 population it is not unusual to find to-day as many as four complete generating stations, of which one or more are idle because of consolidation and now serve only as reserve property of a rapidly declining value. In all such instances the communities have failed to secure competition and have succeeded only in causing heavy increases in the fixed capital devoted to the public service. The error of granting such franchises is now generally recognized, but the result of such policy still disturbs the equilibrium of more than one utility balance sheet.

"Unfortunately, it is often impossible to obtain all the records involved in such consolidation. Frequently the merger has been the means of personal profit through the speculative opportunities which it afforded, and those interested have failed to transfer the old company records or they have not been kept in the manner public service commissions now require. Where, however, the records are available and an analysis can be made of the charges showing the amount of duplication of property resulting after the elimination of all speculative and personal profits, such additions to the plant account are expenditures which should be considered in connection with the development costs which enter into the present value of a unified system. The granting of duplicate franchises was an act of the public which conformed to the generally entertained sentiment of the time that all public utilities should be regulated by competition. It would, therefore, seem that, in a period of greater appreciation of the true economic character of a lighting utility and the creation of administrative machinery for the protection of the people and the investor, the public which to a large extent occasioned these burdens should at least bear a reasonable proportion of such costs. An appraisal of the physical property alone can never give the measure of the 'fair present value' unless a study is also made of the balance sheets and profit and loss statements, together with the detailed accounts from which these were constructed."

Mr. Hagenah also argued for the consideration of discounts on bonds as one of the cost items of constructing a utility. Especially should discounts be regarded as costs where the community is desirous of securing such service but the conditions surrounding the investment raise grave questions as to its early success. Since the industry was established in response to public demands, but funds could not be secured in the open market without the payment of discounts for the risks involved, these discounts should be taken into consideration by regulating bodies since municipalities could not establish the utility without also incurring the discount. He stated in part as follows:

"Another item of cost which the analysis of a construction account frequently reveals is the discount on bonds issued. Such discounts are incurred not only on the original issue of bonds, but on nearly every subsequent issue, although to a gradually diminishing extent as the business becomes more strongly established. Under ordinary conditions the element of discount is inseparably connected with the rate of interest which the bonds carry, but on the organization of the company the cause of the discount is not so much a question of the rate allowed as it is one of security for the principal, making the discount very large, with the result that the bonds, instead of being strictly an investment security, become in fact a highly speculative issue. Not to pay the price for funds as indicated by the discount required at that time frequently results in denying to the community the benefits of the service which it is sought to supply, and it is a question whether the value of obtaining the service at the time should not be considered in connection with the necessity and reasonableness of the discount which was one of the costs of securing it. Where a utility is soon able to show favorable net earnings the

problem of discount on bonds is a simple one. It is where there are no net earnings that the discount must be considered as a cost. Regarded in this light it is a comparatively small burden to the future users of the property, but to make an early amortization of the discount would be to throw the entire burden of securing a permanent industry still in the speculative stage on the early patrons of the property. Aside from the academic rule of accounting that the discount on securities should be amortized over the life of the bonds, the situation which actually confronts the community desiring a lighting plant is a specific condition and not a theory. To the old-established company whose history of operation has been one of gradually increasing profits and with a long sustained dividend record the question of discount on bonds is not so vital in the cost of property as it is with the newer plant. Neither is the present-day discount of an established utility conclusive as to the method to be used in disposing of such costs. Present discounts represent the success of the business at this time as managed by the present organization in the community as it exists to-day. The discounts incurred in the organization and construction of the plant are a gage of the cost of the property when the venture was undertaken and of the confidence with which the community then regarded it. Here, unlike the case of a private enterprise, the city probably had the right to engage in the business itself, just as many did engage in the construction and operation of water and lighting plants. The city may have questioned the success of the industry or its ability to operate it efficiently and considered the risks as outweighing the advantages of ownership. Therefore, after having stood by while others have incurred the risks which the community refused to assume, it should not be permitted now to ignore the costs which could not be avoided in developing the industry, especially if the city itself could not have engaged in the enterprise without meeting the same discounts unless it had pledged a greater security than was provided by the property of the company."

Mr. Hagenah concluded that public utilities should receive credit for the costs incurred in developing their business, and in determining such costs the reasonable and necessary discounts on early construction bonds and the losses due to enforced competition should receive proper weight by rate-regulating bodies.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has ordered the New York Telephone Company to furnish telephone service to the Metropolitan Telegraph & Telephone Company at its offices, No. 135 East Sixteenth Street, upon the complainant complying with all the reasonable rules and regulations of the company and making payment for such service one month in advance. It has also ordered the New York company to place the name of the complainant in its directory of subscribers about to be published, in the usual manner. The resolution of the commission recites that the complainant is a corporation incorporated under the laws of the State of New York as a telegraph and telephone company; that it has not as yet secured a certificate of public convenience and necessity from this commission entitling it to construct its plant in the State of New York, but that it has opened offices in New York and desires telephone service from the New York Telephone Company, which is the sole company affording telephone service in that city. It further undisputedly appears that the New York Telephone Company has refused to afford service, although the complainant is ready to comply with all the reasonable rules and regulations of the New York Telephone Company and pay its regular schedule of rates and charges for the service which it desires. The order further recites that the New York Telephone Company has not presented to the commission any satisfactory or reasonable reason for its refusal to afford service to the complainant. At the hearing it appeared by admission of the complainant that it had unlawfully issued its capital stock to the amount of $10,000 without applying to the commission for authorization so to do; but pursuant to the suggestion of the commission it has since caused the stock to be returned to the company and canceled, so that it has corrected this violation of law so far as it lies within its power at the present time.

The commission has dismissed the complaint of the United States Light & Heat Company against the Niagara Falls Gas & Electric Company, in which the complainant asked the commission to require the Niagara Falls company to furnish gas to it at its plant in Niagara Falls, a distance of 3400 ft. from the nearest main of the gas company. The company made a proposition to construct a main across a 600-ft. bridge on the route, so that in effect, in order to supply gas, it will be necessary to lay an additional main 2800 ft. in length. This main would have to be laid under an asphalt pavement, the cutting and restoration of which would cost the sum of $2,500. The laying of the additional main would cost $4,460. The annual return upon this investment at 6 per cent would be $267.60. The complainant alleged that it was ready to take 20,000 cu. ft. of gas per month, which would return the company but $240 per year, or less than the interest charge alone upon the mains requisite for the performance of the service. No other customer could be obtained along the route over which the main would have to be extended. The resolution recites that, having in mind the cost of the extension, the returns which would be received by the gas company, and the further fact that the complainant could not be required to take gas even if the extension were made and makes no proposition to take gas for any particular length of time, it does not seem right that the extension should be ordered.

NEW JERSEY COMMISSION.

At a recent conference held by the Board of Public Utility Commissioners with representatives of telephone companies it was decided that there should be prepared and submitted to the companies blank forms of schedules on which they are to report the extent to which their contracts vary from standard.

At a conference held on Oct. 16 on proposed rules and regulations for service supplied by electric light companies, numerous representatives of the companies appeared before the board, and the proposed regulations were taken up for discussion seriatim. Representatives of telephone, electric-railway and telegraph companies operating in New Jersey were also present. The conference will be resumed at an early date to be fixed by the commissioners.

The board has filed a memorandum withholding its approval of an ordinance of the borough of Dunellen granting a franchise to the New York Telephone Company. It is stated that approval will be granted if the ordinance is amended in the following particulars: (1) The provision reserving the power of the board should be broadened so as to apply to any commission that may succeed to its powers and duties and so as to include both overhead and underground systems; (2) the ordinance should be made applicable in its terms to all existing and future local rights of the company; (3) provision should be made for the giving of notice by the company to Dunellen before the beginning of any work; (4) if it is desired to retain the section as to the readjustment of the terms of the grant it should be reframed so as to make it clear that it is not the intent in readjustment to confine the municipality to the amount of free service now provided for.

INDIANA COMMISSION.

Representatives of Indiana traction and central-station companies have complained informally to the Railroad Com-

mission that they are in danger of being left without fuel owing to the shortage of coal cars. The commission directed that a written complaint be filed, and promised to investigate the situation and take every action within its power to compel the coal-carrying roads to furnish the necessary cars.

WISCONSIN COMMISSION.

Judge Stevens, of the Circuit Court, has sustained the demurrer of the Railroad Commission to the complaint of The Milwaukee Electric Railway & Light Company in which it was contended that the commission had no authority to order the sale of thirteen tickets for 50 cents, as provided for in the commission's recent decision, because an ordinance passed by the Milwaukee Common Council on Jan. 2, 1900, conferred upon the company the right to collect a 5-cent cash fare during the life of the franchise. The court held that "the provision under consideration is a limitation upon the rate of fare that may be charged and not a contract giving the plaintiff the right to charge a 5-cent cash fare. It follows that the order of the commission does not impair the obligation of any contract and that the complaint does not state a cause of action." The case will probably be carried to the Supreme Court.

The commission has issued a certificate of convenience and necessity authorizing the Badger Railway & Light Company to extend its line of interurban railway from the city of Whitewater to the city of Jefferson. The provisions of the certificate do not cover the character of the crossings of the proposed line with existing railroads or highways, for the commission has reserved the right to pass upon and approve each crossing, etc., at such time as the applicant shall make application to the commission for approval of its plans and specifications. There was no opposition to the granting of the certificate.

CALIFORNIA COMMISSION.

The Railroad Commission has made an amendment to an order granting the Oro Electric Company permission to serve certain territory in San Joaquin County outside of the city of Stockton. The Western States Gas & Electric Company, now operating in Stockton, has received permission to serve certain parts just outside the city limits.

The commission has rendered a decision allowing the Western Union Telegraph Company to put into effect a change of rates, with modifications applicable to a certain class of press associations. The general effect is to reduce rates.

MICHIGAN COMMISSION.

The Vermontville Independent Telephone Company has brought suit against the Michigan Railroad Commission to secure the right to construct and operate a telephone exchange in Eaton and Barry Counties. The commission on Jan. 31, 1912, granted the company a franchise, issued by the Secretary of State, allowing it to issue stock to the amount of $25,000. About $10,000 worth of stock was sold and on Feb. 27 the company petitioned the Railroad Commission for a certificate of public convenience and necessity which would allow it to operate in the villages of Vermontville and Sunfield and the townships of Vermontville, Kalamo, Sunfield and Chester, ultimately reaching other territory in Eaton and Barry Counties. On Aug. 29 the commission denied the petition, refusing to give a certificate as requested, the reasons being that other telephone companies were already operating in the territory and that the proposed new exchange was unnecessary and would injure the business of the established companies.

The Vermontville company, it is reported, will claim that the reasons given by the Railroad Commission are not convincing, that they tend to create a monopoly and would destroy and remove from the State all competition in telephonic service, and that the Legislature of the State has no authority under the constitution to delegate to any body of men the power to create such a monopoly.

Current News and Notes

Faribault-Zumbrota Line Completed.—The high-tension transmission line from Faribault, Minn., to Zumbrota, Minn., has been completed and the local steam-driven electric-light plant at Zumbrota has been shut down. Users of electricity in that place are now supplied with electrical energy from the Cannon Falls hydroelectric station of the Consumers' Power Company.

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Municipal Industrial University.—The town of Lomax, Ill., is to have an "Industrial University," with a board of control composed of experts in mechanical engineering, electricity, chemistry, advertising and business management, with other branches to be added as the needs of the new university may develop. The training is to be given without cost, the object being to secure to all manufacturing interests located at Lomax a highly trained class of employees.

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Hydroelectric Plant at Gatun Dam.—Work has been begun for the erection of the permanent hydroelectric generating station at the spillway of Gatun Dam on the Panama Canal. Excavation for the turbine pits has been carried to 5.25 ft. below sea level over an area of 100 ft. by 30 ft. There will be three penstocks, and when Gatun Lake is at its normal level the effective head on the turbine waterwheels will be 77 ft. Specifications for 350 tons of structural steel for the buildings have been prepared.

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Use of Pulmotors.—Pulmotors have been placed or are to be placed in twenty-three of the public-service properties controlled by H. M. Byllesby & Company, of Chicago. The instrument belonging to the Louisville Gas & Lighting Company, one of the Byllesby group, was used with good effect recently in the case of a patient who was supposed to be dying in a hospital from the effects of shock following an operation for appendicitis. The physician in charge thanked the company for the prompt and efficient work done with the pulmotor. He said that the patient was improving and at the time of writing thought to be out of danger.

* * *

Why Not a Commission to Regulate Domestics?—The last use to which a citizen has asked the New York Public Service Commission, Second District, to bend its energies is in relation to securing a domestic for household service. A resident of Far Rockaway complained to the commission that "I got a girl for general housework through the agency of ——, of ——. She collected a three-dollar fee from me and got another position for the girl inside the week. Will you kindly take this matter under your consideration?" The worthy housekeeper was advised that the commission was without power to aid her in securing a domestic or compelling the agency to furnish her one.

* * *

Overhead Wires Permitted in Chicago Alleys.—On May 13 last the City Council of Chicago passed an order directing the Commonwealth Edison Company and the Chicago Telephone Company to remove all their poles and wires in the alley bounded by Blackhawk Street, North Ashland Avenue, Milwaukee Avenue and Dickson Street. This locality is in the Sixteenth Ward, where aldermen and citizens have conducted a campaign against overhead wires. City Electrician Palmer advised the Mayor, however, that neither of the companies has been compelled to place its wires underground in any of the alleys of the city, and that it would be a hardship to force them to comply with the order. Accordingly, as suggested by the Mayor, the City Council repealed the order on Oct. 7.

N. E. L. A. Resuscitation Booklet.—The National Electric Light Association is distributing in booklet form the "Rules for Resuscitation from Electric Shock" with the chart prepared under its auspices and issued as a supplement to the *Electrical World* of June 1, 1912. The booklet is 3.5 in. by 5.5 in. and is bound in board covers. The chart is so prepared that it can be mounted upon a wall, while the booklet itself is of pocket size.

* * *

Lighting Company Entertainment for Baseball Players.—A banquet was given to the baseball team of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., by the Gas and Electric Athletic Association at the Hotel Belvedere, upon the closing of the baseball season. The guests of honor were Manager W. H. Cassell's twelve players, who made the record of fifteen games won and three games lost. Mr. W. J. Casey was the toastmaster, and the managers of all the competing clubs were present.

* * *

Limitless Energy from One Horse-power.—According to the Line-o'-Type column in the *Chicago Daily Tribune*, a man in Waterloo, Ia., received the following letter: "Dear Sir: Would you be interested in talking with one of the best electrician the world affords? on matters far beyond any thing as yet undertaken by the electrical science. Would it be interesting to you to see and talk with a man who can by means of a small power, for an elustration we will say he can take a one H. P. gas angin and by means of attachments develop at the motor pully any power desired? wouldent this be of interest to you as an electrician? I will go one step further and say, that with a 10 h. p. gas engin hitched to our invention we can drive the largest vessil afloat across the Ocean at its full speed and at a cost of practially nothing, this of course will seem impossible to you, But this is the history of all great inventions, they at one time all seemed impossible, but are today living witnesses of the invention and fact that it WAS possible, am I not right?"

* * *

Boston Edison Credit Union.—Arrangements are being made by the Edison Electric Illuminating Company of Boston, Mass., for the incorporation of a credit union for the benefit of employees, following the lines of work carried out by the Industrial Credit Union of Boston, which numbers Mr. R. S. Hale, of the company, as its vice-president and Messrs. J. W. Cowles and Francis P. Creden, also Edison men, as directors. All members of the Industrial Credit Union who are employees of the company will be allowed to join the new Edison organization without an initiation charge. Mr. H. W. Moses, head of the Welfare Bureau, is looking forward to a large increase in membership about Jan. 1, when it is planned to inaugurate the work of the new union. The object of the union, as in similar organizations in Germany, Italy and India, is to promote thrift and well-being among its members, to establish co-operative relations within its organization, and to enable loans to be financed on a strictly business basis without excessive interest.

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SOCIETY MEETINGS.

Boston Electrical Luncheon.—The first Friday luncheon of the season under the auspices of the New England Section of the National Electric Light Association was held at the American House on Oct. 18, when Representative John W. Weeks addressed about ninety electrical men upon "Postal Legislation."

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San Francisco Section, A. I. E. E.—A meeting of the San Francisco Section of the American Institute of Electrical Engineers was held on Oct. 25 in the Pacific Telephone & Telegraph Company's building at New Montgomery and Jesse Streets. Mr. C. R. Wallis presented a paper on "Modern Improvements in Electric Street Lighting Units," which was illustrated with lantern slides. An informal table d'hôte dinner was served at Jules' café at 6:15 p. m., before the meeting.

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Future Meetings of Commonwealth Edison Section of N. E. L. A.—On Oct. 29 Mr. John M. Ewen will address the Commonwealth Edison Company Section (Chicago) of the National Electric Light Association on "Chicago's Harbor." At this meeting, which will probably be held at Association Hall, it is expected that the result of the election of officers for the section by letter ballot will be announced. On Nov. 7 the annual banquet of the section, which has now about 1700 members, will be held at the Hotel Sherman. At this time the new officers will be installed.

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Joint Meeting of Boston Engineers.—On Oct. 16 the Boston Section of the American Institute of Electrical Engineers held a meeting jointly with the American Society of Mechanical Engineers and the Boston Society of Civil Engineers. Mr. H. L. Cooper, chief engineer of the Mississippi River Power Company, presented a paper, illustrated by lantern slides, on the construction of the dam and generating station of the company at Keokuk, Ia. Mr. D. L. Galusha, of the Stone & Webster Engineering Corporation, followed with a paper on the electrical equipment and design of the station. About 400 members were present.

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Meeting of Boston Edison Company Section, N. E. L. A.—The annual meeting of the Boston Edison Company Section of the National Electric Light Association was held at Paul Revere Hall, Boston, on Oct. 16, and the following officers were elected for the ensuing year: President, Mr. H. W. Moses; vice-presidents, Messrs. J. W. Cowles and C. H. Crockett; secretary, Mr. S. R. Keyes; treasurer, Mr. C. H. Miles. Messrs. W. H. Cole and C. S. Hadaway were elected to the executive committee. Following the business meeting, papers illustrating the production of electricity from coal pile to meter were read by Messrs. C. H. Parker, L. L. Elden and J. W. Cowles.

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Philadelphia Section, I. E. S.—The regular monthly meeting of the Philadelphia Section of the Illuminating Engineering Society was held at the Franklin Institute on Oct. 18. Papers were presented by Dr. W. Zentmayer on "Physiology of Vision and Causes Other than Defective Illumination for Eye Strain" and by Dr. C. E. Ferree on "Tests for the Efficiency of the Eye Under Different Systems of Illumination and a Preliminary Study of the Causes of Discomfort." The papers were discussed by Messrs. H. Calvert, Norman Macbeth, W. J. Serrill, H. E. Ives, G. B. Regar, C. O. Bond, J. S. Ely, J. D. Israel and C. W. Hare. Prof. Arthur J. Rowland presided.

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Plans of Electric Club of Chicago.—By invitation of the trustees of the Sanitary District of Chicago the Electric Club of that city will take a trip down the Drainage Canal to the hydroelectric power house at Lockport, Ill., on Saturday, Nov. 2. The party will board the Sanitary District's steamer *R. R. McCormick* at the State Street bridge at 10 a. m. Luncheon will be served on the boat and will be provided by the club. Announcements for future luncheon meetings of the club have been made as follows: Nov. 7, "Electrical Inspection," by Mr. Victor H. Tousley, chief inspector of the Department of Electricity of the city of Chicago; Nov. 14, "The Quartz-Tube Mercury-Vapor Lamp," by Mr. George C. Keech, illuminating engineer of the Cooper Hewitt Electric Company.

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Boston Electric Vehicle Club Officers.—At a regular meeting of the Electric Vehicle Club of Boston on Oct. 23 the following officers were elected for the ensuing year: President, Mr. Day Baker; vice-president, Mr. E. S. Mansfield; secretary, Mr. H. F. Thomson; treasurer,

Mr. J. S. Codman; executive committee, the foregoing and Messrs. F. N. Phelps, M. J. Fitch and F. J. Stone; finance committee, Messrs. F. M. Kimball, W. H. Blood, Jr., and F. J. Stone; meetings committee, Messrs. L. L. Edgar, A. F. Neale and H. L. Converse; advisory committee, Messrs. J. W. Bowman, Albert Weatherby, H. E. Taylor, C. D. Daly, D. C. Tiffany, G. W. Holden, J. W. Emery, P. E. Whiting, C. A. White, J. A. White and L. A. Tirrill. The club is now being reorganized on a self-supporting basis and has about seventy members.

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Baltimore Company Section, N. E. L. A.—The annual election of officers and executive committee of the Baltimore Consolidated Section, N. E. L. A., for the ensuing year was held on Oct. 15 in the physical laboratory of Johns Hopkins University. The following officers were elected: Mr. J. T. Kelly, Jr., president; Mr. L. L. Heyden, vice-president; Mr. D. C. Bruce, secretary, and Mr. R. F. Bonsall, treasurer. Executive committee: Messrs. R. H. Tillman, A. W. Bull, E. D. Edmonston, William Schmidt, R. C. Niles, F. M. Weller and W. P. Beyerle. In connection with the lectures to be given by Prof. J. B. Whitehead, of Johns Hopkins University, it is the purpose of the association during the coming year to take up various branches of elementary work.

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New York Electrical Society.—The three hundred and thirteenth meeting of the New York Electrical Society will be held Tuesday, Oct. 29, at 8 p. m., in the Doremus lecture room of the Chemistry Building of the College of the City of New York, and will be addressed by Dr. Charles Baskerville, F. C. S., professor of chemistry and director of the college laboratory, who will lecture on "Tungsten." The lecture will be illustrated by exhibits of minerals, tungsten alloys and equipment in which metallic tungsten is employed. Stereopticon slides will also be shown. Dr. Baskerville will describe the history, occurrence, extraction, properties and uses of tungsten, its compounds and alloys. Particular attention will be given to the manufacture of metallic tungsten filaments for incandescent lamps. The lecture on tungsten will be followed by a talk by Dr. Alfred N. Goldsmith, instructor in radio-engineering, describing the equipment in the college laboratory for experiments in radio transmission and a brief account of the course of instruction offered to engineering students in this specialty. Those present will afterward be taken on a tour of inspection through the laboratory.

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Seattle Section, A. I. E. E.—The October meeting of the Seattle Section of the American Institute of Electrical Engineers was held on Oct. 19 in the assembly hall of the Central Building. Dr. C. E. Magnusson, of the University of Washington, who has spent the past year in the East in special research work, read a paper on "A Western Engineer in the East," in which were set forth recent developments and methods of Eastern practice. The chairmen of the recently arranged membership groups announced their plans, and the complete year's program was made and passed upon by the section at this meeting. The membership grouping for 1912 was as follows: Railway group, Mr. A. A. Miller, Westinghouse Electric & Manufacturing Company, chairman; transmission, substations and distribution, Mr. Glen Dunbar, Municipal Lighting Plant, chairman; power stations, steam and hydraulic, Mr. J. Harisberger, Puget Sound Traction, Light & Power Company, chairman; telephone and telegraph including wireless telegraphy, Mr. L. P. Crim, Pacific Telephone & Telegraph Company, chairman; electrophysics, Dr. C. E. Magnusson, University of Washington, chairman; electric lighting, including interior construction and illumination, Mr. E. S. Code, Westinghouse Electric & Manufacturing Company, chairman, and industrial power, Mr. W. S. Hoskins, Hoskins Machine Works, chairman. To each group had been assigned one meeting during the coming year, including the selection of the subject and the furnishing of the paper. The revised set of by-laws, prepared by the executive committee, was presented and a report thereon submitted.

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New York Jovian Luncheon.—The regular New York Jovian luncheon was held on Oct. 23 at the Imperial Hotel, on which occasion, after brief introductory remarks by Secretary T. C. Martin of the National Electric Light Association, the newly elected Jupiter, Mr. Frank E. Watts, was enthusiastically received and made a short address. Mr. Watts referred to the change in name of the order from the Rejuvenated Sons of Jove to the Jovian Order. The growth of the organization has been rapid and it now numbers 8500 members. He referred also to the formulation of plans for the annual convention of the whole order which will be held in New York City on Oct. 14, 15 and 16, 1913. Mr. Watts referred to the dawn of a new era in the affairs of the order and the intention to devote its energies to some serious purpose. In this connection he spoke of the electrical co-operative movement which is now being actively promoted by many interests in the industry. He closed with the announcement of the appointment of Mr. Joseph F. Becker, contract agent of the United Electric Light & Power Company, as statesman for New York City. Mr. Becker made a few remarks, stating that the luncheons will continue hereafter on alternate Wednesdays at the Hotel Imperial. He announced also that a rejuvenation will be held in New York City in December and that thirty-five or forty candidates are already enrolled. Brief remarks were made also by Mr. C. L. Eidlitz, electrical contractor, 1168 Broadway, and Mr. F. W. Smith, vice-president of the United Electric Light & Power Company, both of whom urged that the order take up serious work.

* * *

Annual Convention of Railway Signal Association.—The seventeenth annual convention of the Railway Signal Association was held at Quebec, Can., on Oct. 8, 9 and 10, at which time an extended program, composed mainly of committee reports, was taken up for consideration. Considerable interest was manifested in the 130-page report of the committee on electric railway and alternating-current signaling, presented by Chairman H. S. Balliet. Much information was submitted in reference to alternating-current signaling in Europe and America, and numerous important installations in this country were described. The report of the storage-battery committee, presented by Chairman R. B. Elsworth, stated that its recommendations represented conclusions which had been reached after reconciling the divergent views of manufacturers and others. The specifications submitted were asserted to represent the best existing practice. Chairman W. H. Elliott, of the committee on wires and cables, presented a report recommending numerous changes in the standard specifications. There was considerable discussion over the specifications for copper-clad steel line wire. In the discussion on rubber compounds there were objections to the table prescribing the ingredients, on the ground that these represented the practice and product of some particular manufacturer. It was replied that the list represented the consensus of prominent makers' practice at present, and that some such standard is necessary in order to enable signal engineers to secure intelligible records and data for comparison. The following officers were elected for the ensuing year: President, Mr. B. H. Mann, Missouri Pacific Railway; first vice-president, Mr. F. P. Patenall, Baltimore & Ohio Railroad; second vice-president, Mr. Thomas S. Stevens, Atchison, Topeka & Santa Fé Railroad; secretary-treasurer, Mr. C. C. Rosenberg, Bethlehem, Pa. The new members of the board of directors, to serve for two years, are as follows: Mr. J. C. Young, Union Pacific Railroad; Mr. H. V. Lewis, Lehigh Valley Railroad; Mr. R. E. Trout, St. Louis & San Francisco Railroad, and Mr. C. A. Dunham, Great Northern Railway.

ROCK RIVER HYDROELECTRIC DEVELOPMENT

Low-Head Station at Sears, Ill., Characterized by Directly Connected Vertical Generators and Other Noteworthy Features.

Present Installation Comprises Six 300-kw Units—Output Sold in Bulk for Railway and Lighting Purposes—System Privately Owned and Managed.

AT Sears, Ill., on Rock River, 3½ miles above the junction of that stream with the Mississippi, a hydroelectric generating station has been installed by Messrs. T. B. and S. S. Davis, of Rock Island, which involves some unusual features. The installation is of importance not only because it is one of the first low-head (13-ft.) plants wherein each vertical generator is directly connected to its own waterwheel to be placed in operation in the United States, but also because of certain novel methods utilized in the construction of the station building and in the arrangement and installation of the apparatus. The power house is situated about a quarter of a mile below Black Hawk's Watch Tower, an eminence commanding an extensive view of the beautiful Rock River Valley. In these days, when nearly all public utilities are owned by corporations, it is singular that the plant here described is the property of the two Davis brothers and that it was built under their immediate supervision. All the energy developed is sold to the local railway and lighting company.

The present equipment of the station consists of six Westinghouse 300-kw, 2400-volt, three-phase, 60-cycle, 72-r.p.m. vertical generators, each driven by a 69-in. turbine, and the apparatus necessary for metering and controlling the output of the machines. Provision has been made for the installation of six more generators of the same characteristics, and when these are in p'ace the station will have an aggregate rating of 3600 kw.

It will be noted that the topography of the land adjacent to the station is such that Carr's Island and Vandruff's Island form an almost perfect natural canal, approximately 1¾ miles in length. By the erection of dams Nos. 1, 2 and 3 a head of 13 ft. is obtained at dam No. 3. For years the power on both branches of the river was used for driving flour and straw-paper mills, but changing industrial conditions rendered the locality unsuitable for these enterprises and the mills ceased business, the water-power was unused

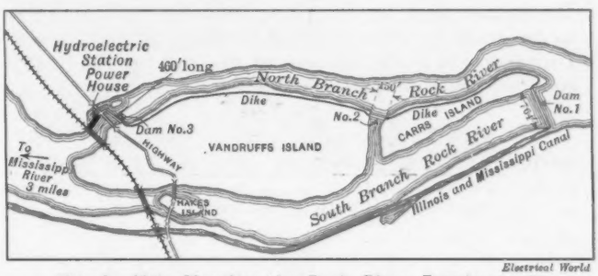


Fig. 2.—Map Showing the Rock River Developments.

and the hydraulic improvements were allowed to go to wreck. In 1892 the government constructed a dam across each branch of the river at the head of Carr's Island for the purposes of the Illinois and Mississippi Canal. Recently the Davis brothers purchased the water rights involved and with the approval of the United States government rearranged the dam system and built new dams. The dams built by the Davis brothers do not interfere in any way with the operation of the canal. In fact, they have caused

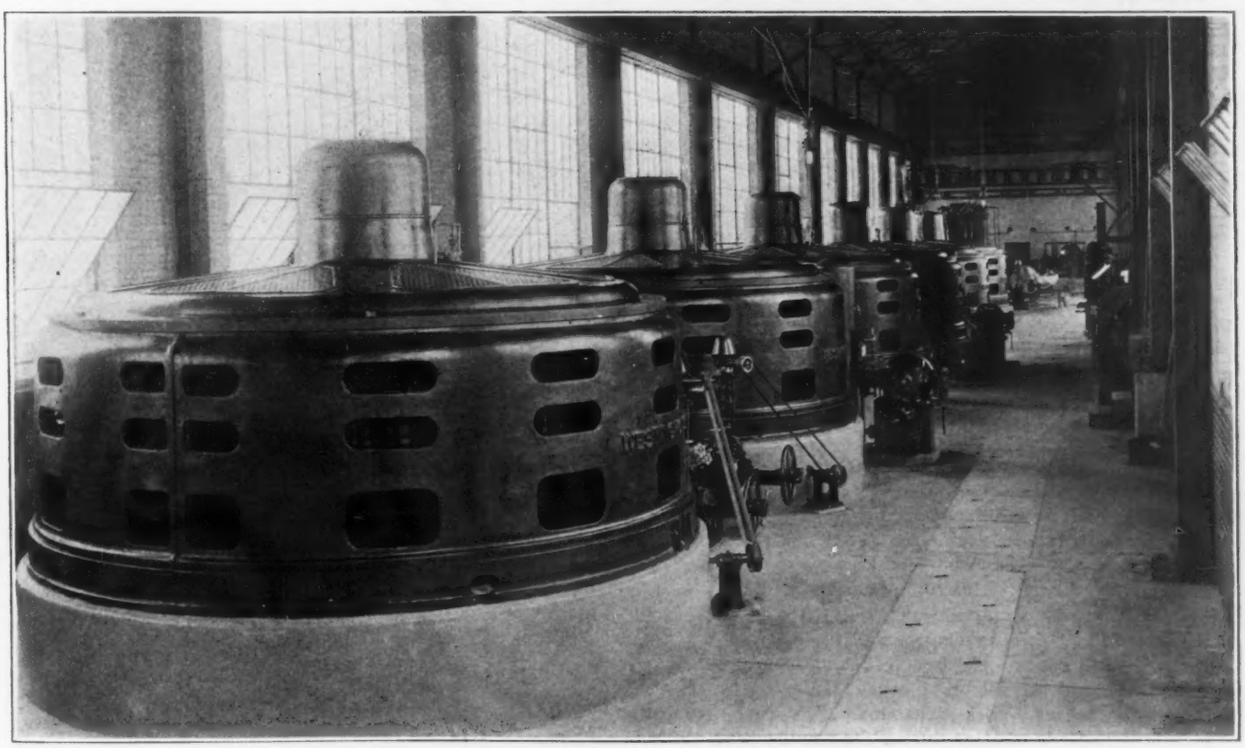


Fig. 1—Generating Room of Davis Brothers' Hydroelectric Station on Rock River at Sears, Ill.

a decided improvement, because the present structures are of solid concrete and rest on solid rock, which insures the utmost permanency, while the old ones were of timber.

No wood enters into the construction of the station building. Even the roof is of concrete tile, and the concrete used elsewhere is heavily reinforced with steel. In general the arrangement is typical of that used for modern high-class vertical type generators, but there are some innovations worthy of notice. One is the provision of a tunnel or gallery just under the generators. Grooves were molded in the concrete side walls of the tunnel, and in these grooves the cables from the generators to the switchboard are carried. The pressure oil piping for the operation of the governors is also supported within the tunnel. For closing any penstock in an emergency steel gates which slide down in grooves on the upstream side of the penstocks have been provided. Removable concrete slabs have been arranged in the floor over the grooves, and any set of slabs can be removed and the steel gates lowered to position with the bridge crane. Valves have been mounted in the gates whereby the hydrostatic pressure can be equalized when a penstock is empty, to permit the ready removal of the gates. Pressed brick is used for the walls both inside and out, and a wainscot of a darker brick is carried around the inside. Steel frame windows of generous proportions provide an abundance of light.

The 69-in. turbines that drive the main generators are of the S. Morgan Smith type. Their speed, 72 r.p.m., was based on a 9-ft. head, that speed being the most economical at that head. Woodward governors control the speeds of the wheels, and each governor is provided with a regulating motor manipulated from the switchboard, so that the operator, when synchronizing, can change the speed of the unit from that location.

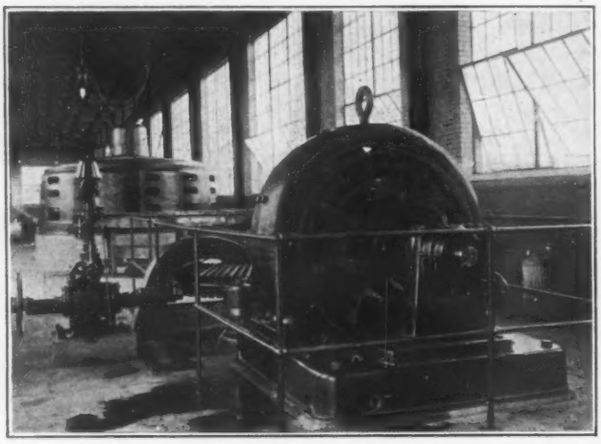


Fig. 3—Geared Waterwheel-Driven Exciter.

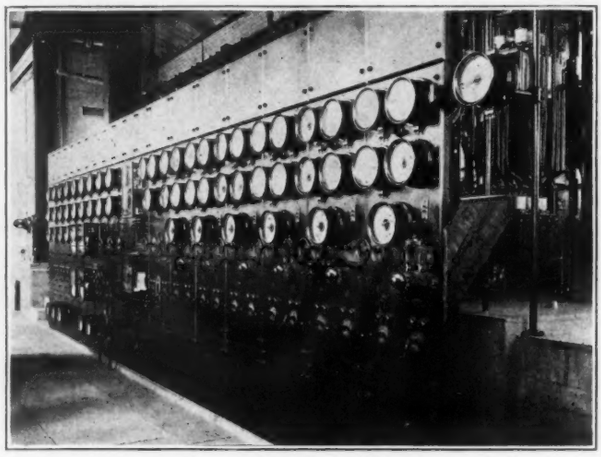


Fig. 5—Switchboard.

To furnish excitation energy a Westinghouse 150-kw, 125-volt, 260-r.p.m. horizontal generator has been installed. It is driven by a 51-in. S. Morgan Smith vertical waterwheel running at 120 r.p.m., and the speed reduction necessary is effected through bevel gears. An auxiliary Westinghouse 150-kw motor-generator set is also provided and is located near the switchboard. The motor is a 2300-volt, three-phase, 60-cycle synchronous machine. Space has been allowed for a duplicate waterwheel exciter set. A remotely control'ed, electrically operated switch gear, mounted directly on the station floor and extending back into a bay provided for it, controls the output of the generating equip-

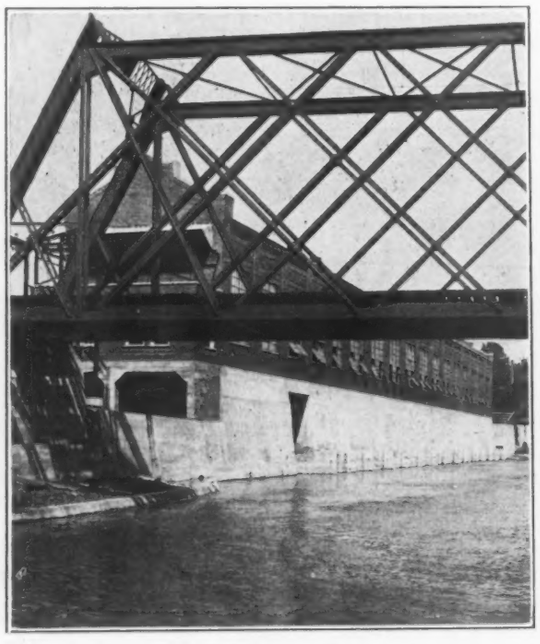


Fig. 4—View of Station and Dam No. 3.

Fig. 6—Outgoing Circuits at End of Station.

ment. All wiring and apparatus is mounted on a pipe framework.

A considerable portion of the output of the station is delivered at 2400 volts to a feeder line of that pressure which passes the station and which belongs to the local lighting company. However, some of the energy will be transmitted at 33,000 volts to distant substations, and for stepping up from the generated pressure of 2400 to the the transmission pressure of 33,000 two 200-kw T-connected (three-phase to two-phase) transformers and one 2000-kw three-phase transformer have been installed. It is the intention to install another 2000-kw transformer later..

There are two 33,000-volt, three-phase transmission lines to Rock Island, and high-tension switching equipment has been provided whereby one or both of the 2000-kw transformers (only one of the 2000-kw transformers is now installed) can be connected to either line. Electrolytic lightning arresters protect the transmission circuits.

PHYSICAL PHOTOMETERS.

By J. S. Dow.

PROGRESS in the design of small and convenient instruments for measuring illumination has really been most remarkable during the last few years. Both in America and in Europe a number of types have been introduced. The intention throughout has been to obtain simplicity and convenience rather than extreme accuracy. On the other hand, laboratory methods have also been brought to a greater stage of perfection. Much of the old uncertainty on the subject of "personal errors" and other phases of difficulty has been removed. Even the complexities of color photometry are now more fully understood and appear less formidable. The scientific difficulties are certainly very great; but it is probable that the inconvenience of such effects in industrial photometry is not so great as was at one time feared. It is only with such exceptional sources of light as the mercury-vapor lamp and at very low illumination that serious difficulty is experienced.

There is one possible line of development in photometry which does not seem to have been exploited to any great extent as yet; namely, the use of so-called "physical" methods of measurement. By this term is understood the direct effect of light on some substance or instrument independent of the eye. Some suggestive remarks on this subject were made in the September, 1912, issue of the *London Illuminating Engineer*. Our views of the possibilities of such instruments seem to be passing through various stages. Originally the design of a photometer based on such principles as the chemical effect of light on photographic paper was considered by many as quite within the range of possibility. Indeed, the method was used to some extent. But with increasing knowledge of the laws of radiation and of the difference in the distribution of light in the spectra of various artificial illuminants the inherent difficulties of such apparatus became more evident. It is clearly a supremely difficult task to find a physical method of measuring light which can produce results at all consistent with those derived through the eye. Yet it is not apparently impossible and perhaps is not always even necessary. In the light of our improved knowledge the possibility of using such methods for practical measurements does not seem quite so remote. At any rate there is now a better understanding of the real difficulties, and eventually a method of circumventing them may be found.

There appear to be two distinct classes of work to which physical methods can be applied. First, there are those in which purely comparative results are needed; for example, in comparing the candle-power of the same source in different directions, the supposition being that the quality of radiation is the same and that only the intensity alters. Similarly, in taking measurements of the illumination of a room, the variation in daylight, the effect of employing certain shades or reflectors, etc., we are usually dealing only with comparative results.

On the other hand, if it is desired to compare entirely different sources which do not radiate the same kind of energy, and which emit different percentages of their total radiation in the form of visible light, a much more difficult problem is encountered. Physical methods of measuring light, in order to give consistent results, must analyze the light received in exactly the same manner as does the eye.

The use of physical methods for obtaining purely comparative results is hopeful, and serviceable work has already been done in this way. Before the illumination photometer came into general use a conception of the distribution of light in a room was sometimes gained by distributing strips of light-sensitive paper in different parts of the room and observing whether, in a given period of time, they had darkened to the same extent. By this method one can obtain at least qualitative results; that is to say, one can perceive that the illumination in parts of the room where the paper does not darken sufficiently should be strengthened. This method has sometimes been applied in connection with ancient light cases; for example, in determining what change in the light has been caused by the erection of some adjacent obstruction outside the building. It is, of course, used in the actinometer employed in photography, for which it is clearly adapted, since the chemical effect of the light rays is the thing we are mainly interested in. The actinometer, in short, discriminates between a source which is rich in ultra-violet rays and one which is weak in this kind of energy in very much the same way as an ordinary photographic plate will do. In the case of plates that are specially sensitized to the visible rays its rigorous application seems less certain.

At various times photometers have been developed utilizing the effect of light on photographic paper. It seems evident, however, that the method can never compete for convenience and accuracy with the illumination photometer proper. Its sole advantage is the fact that no portable standard of light is required. There are, however, one or two special cases in which it may be of service. For example, it has been used as a means of estimating the distribution of brightness in the spectra of various illuminants. Granted that one can secure a plate which is sensitive to the various colors in exactly the same manner as the eye, and that certain requirements as regards exposure and developments are complied with, it is justifiable to assume that the density of the image on the plate is proportional to the visible light received. This method was used with good results by Ives and Coblentz in their researches on the firefly spectrum, the luminosity of which is so weak as almost to defy ordinary photometric methods. More recently Ives has applied the photometric method to the determination of polar candle-power curves of light distribution. A strip of light-sensitive paper is wound in the form of a cylinder and arranged with the source of light to be tested at its center. Under suitable conditions as regards exposure and development, the darkening of the paper will then be proportional to the intensity of the light striking it at that point.

One advantage claimed for this ingenious method is that it can be applied with special success to irregular flickering sources. For it acts as a "ballistic photometer" and automatically records the average light during a given period.

Photography and photometry work very well hand in hand in the study of lighting installations. A photometric measurement of the surface brightness of the objects photographed has been found to be an excellent guide to the exposure necessary, especially in the case of artificial light.

This is the converse process to what has previously been discussed; that is, the use of photometry as an aid to photography. When, on the other hand, we use photographs to

show how the illumination in a room is distributed considerable care is necessary to secure a faithful result. Comparisons of various installations made on this basis may easily prove misleading unless the conditions regarding the nature of plate used, exposure, development and other points are absolutely identical in the various cases.

There is another possible form of physical photometer, the thermopile. A thermopile with a blackened surface measures the total energy radiated from a source and does not discriminate between the luminous and the invisible energy.

It cannot, therefore, be readily used to compare different types of illuminants. Some observers have attempted to do so by using special screens calculated to transmit only the visible energy. Measurements obtained by this means appear somewhat uncertain, although the extent of error may perhaps be reduced.

On the other hand, the thermopile lends itself better to purely comparative measurement. Voege[1] has used it with advantage in order to obtain polar curves of light distribution, and experiments in the same direction have been carried out by Felton and Brady in the United States, as recorded in a paper read at the annual convention of the Illuminating Engineering Society, 1910. In order to be accurate, this presupposes that the kind of radiation given out is the same in all directions. In the case of electric incandescent lamps this may be substantially correct, although even here conduction and convection currents may play some part. But in the case of gas lamps the amount of heat is more likely to vary in different directions, according to whether or not the rays have to pass through a glass envelope, and this would distort the form of the polar candle-power curve.

Another purpose for which this method has possibilities is for recording the fluctuations in light of an unsteady source of light. Voege has found the thermopile to be a useful means of registering the steadiness of arc lamps, and there certainly seems a need for some standard method of obtaining such data.

One can also imagine that a highly sensitive thermopile might be used to detect very small changes in light—for example, to study the effect of slight alterations in the conditions of working of such sources as the Harcourt pentane 10-cp lamp. Minute and suggestive differences such as can readily be observed by ordinary photometric methods might conceivably be detected in this way.

Another form of physical photometer that will readily suggest itself is the selenium cell. This metal, it is well known, changes in electrical resistance when exposed to the action of light. The cells have commonly been used in the past in somewhat the same way as a photometer on an ordinary bench. That is to say, a source of light is stationed at a certain distance and the resultant deflection of the galvanometer noted, and then the second source is brought up until the deflection is the same. The intensities are then assumed to be proportional to the squares of the distances. This method, it will be observed, overcomes any difficulty that may arise as to the relation between the intensity of the light and the reading of the galvanometer.

The ideal type of selenium photometer would take the form of a small box to be presented toward the source of light, the indications of a pointer being noted. This, of course, assumes that the connection between the light stimulus and the deflection is accurately known, that it will not vary with time or be much affected by the inertia of the cell after exposure to light. The difficulties caused by the inertia effect may be considerable, although it is stated that with the latest forms of cells the inertia is appreciable only when the light stimulus is very great.

There is, however, another and even greater difficulty; namely, the sensitiveness of the cell throughout the spectrum is distinctly different from that of the eye. Pfund[2] has recently published some curves showing the distribution of sensitiveness of selenium cells throughout the spectrum of the Nernst lamp. The maximum is in the red range near 0.7 μ. The maximum sensitiveness of the eye, on the other hand, is situated in the yellow-green. However, the selenium maximum is at least within the visible spectrum, and, all things considered, this fact is one of an encouraging nature.

One very curious fact has been related by Pfund, who observed that the maximum shifts toward the red with increasing stimulus. At low illuminations it is actually in the yellow. Professor Ruhmer makes two forms of cells, termed respectively "hard" and "soft." The former are highly sensitive to very intense light and comparatively insensitive to faint light, while the "soft" cells behave in an exactly contrary manner. Moreover, maximum sensitiveness of the "hard" cells lies in the red, while the maximum of the "soft" cells is located in the green.

The interesting thing about this phenomenon is its remarkable resemblance to the Purkinje effect experienced by the eye. At high illuminations, it is well known, red objects tend to appear unduly bright. At weak illuminations the red appears almost dead black, while the green shines out in a most peculiar manner. This effect has been explained by Lummer and others on the supposition that two sets of small organs on the retina of the eye, the rods and the cones, struggle for predominance according to the intensity of the illumination. The theory has received much attention from those interested in photometry, and the author has found that it explained some known effects remarkably well. Yet some authorities seem now to disbelieve it. It has been suggested that the Purkinje effect is merely a phenomenon characteristic of all photochemical changes and therefore experienced by the photochemical pigment in the eye.

In any case it is most interesting to observe the apparent existence of a Purkinje effect for the selenium cell. Seeing that the sensitiveness to color of selenium cells is now getting under control, it seems conceivable that one might ultimately reproduce the luminosity curve for the normal eye exactly. In these circumstances the selenium cell should see just what the eye does. On the other hand, it does not appear possible at present to imitate other ocular actions to reproduce, for example, the adaptation to light and darkness and the varying sensitiveness at different points on the retina which give rise to what is known as the "yellow spot effect."

Owing to the fact that the relative brightness of different colors depends both on the state of adaptation of the eye to light and darkness and on the region of the retina on which the luminous image is received, it is evident that the exact shape of the luminosity curve for the eye is somewhat uncertain, though its general nature is known. This is a great difficulty in the way of standardization of color photometry and shows that too great exactitude in this respect cannot reasonably be expected of any physical photometer.

These researches on the selenium cell, in short, provide an interesting illustration of what was said at the commencement of this article. They show that the complexities connected with the use of such cells are gradually being unraveled, and it is conceivable that a time may come when their use in practical photometry may become an accomplished fact. For purely comparative measurements (records of variation in daylight, etc.) they have already been experimented with and apparently with promising results. But we may feel sure that whatever form of physical photometer is ultimately developed it will always be necessary to calibrate it from the eye by which our impressions of the appearance of illuminated objects of every kind are received.

[1] *Electrotechnische Zeitschrift*, Jan. 16, 1908.

[2] *Physical Review*, Vol. XXXIV, May, 1912.

RECENT TENDENCIES IN FOREIGN LIGHTING PRACTICE.

By Dr. Louis Bell.

THE last three or four years have made much difference in the relative standing of American and European work in electric lighting. In the early days of the metallic-filament lamp and of the flame arc we were decidedly behind the game. The metallic-filament lamp was looked on here with eyes not altogether friendly, and the flame arc, breaking in as it did on the beautiful symmetry of inclosed-arc lighting, was held as a dangerous interloper. In fact, both these illuminants were, so to speak, greeted at the wharf with suspicion, as if they were anarchists with bombs in their pockets. This stage of the game passed very rapidly away, to be succeeded by an aggressive campaign of improvement, as so often happens. At the present moment there is every reason to believe that the American-made metallic-filament lamp is at least as good as the best product manufactured abroad and probably somewhat more uniform. The attack of the flame arc on our equanimity was likewise fruitful of good results. It immediately brought about the high development of the magnetite arc with its long life and beautiful quality of light.

In similar fashion, the true long-burning flame arc, just beginning to appear in European practice three or four years ago, showed such promising qualities that the work of development was taken up here with the result of producing lamps of this type for both yellow and white flame, direct and alternating current, apparently quite up to anything which has been produced abroad. We may, therefore, congratulate ourselves on having kept up well with the procession in these important particulars. Meanwhile, what has the vanguard on the Continent been doing and in what ways has the trend of practice moved forward or changed in the last few years?

In the development of metallic-filament lamps considerable has been doing abroad, especially in the way of small units and lamps for high voltage. The appearance of the 15-watt tungsten lamp for 110 volts or thereabouts abroad was shortly followed by a similar development here. But these little lamps have apparently come into much larger use under Continental conditions than the similar sizes here. Lamps of approximately this size for even 220 volts are produced abroad, not in any great quantity, however. The latest foreign development is a wire-drawn tungsten lamp for voltages from 90 to 120, consuming only 7 watts and giving 5 cp. Whether such a lamp, which costs substantially the same as the more ordinary sizes of tungsten lamp, will find a large market abroad or would find one here may perhaps be open to question. It certainly has a field for usefulness on a modest scale, although American lighting practice has never used small units to anything like the extent to which they are used abroad. Even the 8-cp or 10-cp lamps, always easily obtained and at times extremely useful, have never been employed except for sign lighting on any considerable scale in this country; and one may doubt whether the very small sizes of tungsten lamp would here find large use. Nevertheless, the appearance of the 7-watt wire-drawn tungsten lamp as a regular commercial article abroad is interesting proof of the advance which was made possible when the wire-drawn filament came to the front.

A good deal has been written of late regarding the efficiency at which wire-drawn lamps can be operated. The tendency abroad has been to push them rather harder than is usually thought advisable here, and figures of 0.8 watt and 0.9 watt per hefner candle are frequently quoted. It seems rather doubtful whether these results fairly represent the ordinary trend of commercial practice on the Continent. The latest reports seem to show that when one gets down to the vicinity of 1 watt per candle a difference of 0.1 watt per candle may easily cut the life of the lamp in half. With the larger lamps, from 100 watts up, the chance of working at increased efficiency seems much better than with the sizes more commonly used, to judge from the German reports, but how far beyond our ordinary practice in this country efficiencies can be increased without a real economic loss in the long run, owing to shortened life, has not yet been made clear. We have been through this high-efficiency and short-life proposition years ago with respect to the carbon-filament lamps, and while it was easy to show on paper a great economy in burning filaments at very high efficiency and then throwing the lamps away, the proposition never seemed to work out successfully in practice, and one must not, therefore, jump to the conclusion that the foreign reports of high working efficiency mean that our foreign confrères are really ahead of the game, They may be only learning at some cost the lesson long ago enforced in similar trials with carbon lamps.

With respect to arc-lamp practice the foreign situation is more interesting. There, as here, the long-burning flames are making progress, but the short-burning flame lamp, not popular here, seems there still to hold a very important place. One type of short-burning flame, not known to any considerable extent here, seems to have a considerable usage in foreign practice; that is, the flame lamp at low wattage, say 300 or less, and working at a voltage that permits a pair of lamps to be worked in series on the ordinary low-tension circuit. The difference here is exactly such as was found in the case of the old open-arc lamps, where two or even three were worked in series abroad in cases where we were using here an inclosed-arc lamp of much less efficiency and wasting a good deal of energy in the accompanying rheostat. The relatively high cost of carbons and trimming in this country must be charged with the difference in practice in both cases. Many of the differences which exist in arc lighting and render recent European practice radically different from our own also turn on the fact that for street work we depend almost wholly on series lamps, which are preferably worked on a rather small current, while the pure-flame arcs work best with a fairly high current, like the open carbon arcs, and consequently lend themselves very readily to the multiple connection in almost universal use on the Continent. This same difference of engineering practice has made itself felt in the matter of the quartz-mercury arc, which has in the last few years made a good deal of headway abroad. Being admirably fitted for work on 220-volt circuits, it lends itself with great readiness both to commercial use and street lighting in Continental practice, while here the fact that there are no series lamps available as yet has tended to keep it out of street-lighting work.

Mention here should be made of the cadmium amalgam quartz arc which has recently been developed, at least in the experimental stage, abroad. In this lamp, which works very much after the manner of the ordinary quartz arc, metallic cadmium held vaporized by the arc is the chief source of light, just enough mercury being added to bring the color, which with pure cadmium would be reddish, up to a pretty good white. It is altogether too early to predict the place of this theoretically very interesting lamp in the art, but a quartz vapor lamp giving practically white light certainly sounds attractive.

Altogether the most interesting lamp of foreign origin, however, is the neon tube, a development in principle from the Moore light of this country, but utilizing neon as the illuminescent gas. The color of the light is a beautiful deep orange, altogether pleasant in tone and giving an efficiency considerably better than that of any other gas hitherto tried, as low, it is claimed, for a tube about 20 ft. long as 0.8 watt per mean spherical candle-power.

Some other very interesting developments in vapor lamps are rumored from foreign sources, and it looks very much as though one would have to reckon with the vapor lamp in practical illumination during the next few years to an

extent that has hitherto been little suspected. The idea of obtaining light from metallic vapor or gas which remains unconsumed and works steadily along for the long life of the containing tube is, of course, a very alluring one.

In conclusion, one must remember as a general cause of foreign activity in improving electrical illuminants the sharp competition due to the increasing use of high-pressure gas in illumination both indoors and out. It is unquestionably making a good deal of headway abroad, and while it may be temporarily unpleasant to the electrical fraternity, the inevitable result is going to be improvement in electrical illuminants. Being kicked upstairs is not altogether pleasant but is sometimes beneficial.

ELECTRIC-VEHICLE BATTERIES.

At the recent Boston convention of the Electric Vehicle Association of America considerable attention was paid to storage batteries for electric-vehicle propulsion, papers on lead and nickel-iron cells and on battery-charging apparatus being presented for discussion.

LEAD-BATTERY DEVELOPMENTS.

In a paper on developments in vehicle batteries Mr. Bruce Ford discussed the improvements which have been effected in the "Ironclad Exide" lead cell in the two years which have elapsed since it was placed on the market. Experience shows that the "Ironclad" construction is prolonging the life of positive plates to about three times that of the standard flat plate positive. No renewals have been made because of any inherent weakness in the plates. The conductivity of the pillar strap connector has been improved by integrally welding the copper and alloy together. The grain of the wood used in the construction of separators has been made horizontal instead of vertical, thus eliminating the splitting which formerly occurred, and an investigation of different kinds of wood has resulted in the preparation of separators having greatly increased powers of resisting the action of the electrolyte. The formation of moss-growth around the edges of separators across the tops and bottoms of plates has been overcome by incasing the top and bottom frames of the positive plates in a rubber sheath which is then vulcanized in position directly to the tubes of which the main body of the plate consists. The outside tubes of the positive plates are now equipped with an unslotted tip of rubber, to prevent breakage at this point. Every improvement in the battery becomes a corresponding improvement in the vehicle as a whole and in the service derived therefrom.

THE EDISON STORAGE BATTERY IN SERVICE.

Under the above title Mr. Harold H. Smith reviewed the history of Edison battery development, emphasizing the pains taken to secure a thoroughly reliable and satisfactory product before permitting it to remain upon the market and describing the construction, types and electrical characteristics of the latest equipment. The author emphasized the point that the Edison battery of the present type has now been in service about four years, during which an absolutely clean slate has been maintained in all cases where reasonable care has been accorded. Based on performances given in curves accompanying the paper, it was stated that the battery has been conservatively guaranteed to deliver full rated service after four years' use, and that instances have arisen where consumers are estimating depreciation on the basis of five and six years' life.

The public is demanding a battery which may be charged in so short a time as to limit in no way the service required, but this ideal has not been attained in the present state of the art. In certain fields, however, it may be closely approximated by boosting at high rates, and the Edison battery is well adapted to such use because it will withstand a comparatively high temperature and also because vigorous gassing will not precipitate active material from the plates. This feature has been taken advantage of in street and interurban railway service operated by storage batteries, where boosting during the layovers at the ends of the route has been found highly effective. A storage-battery line in Washington is now in operation in which the battery is seldom regularly charged. The line is 4 miles long and with the exception of about 400 ft. is composed of grades, the maximum being 9 per cent. The car has a five-minute layover at each end of the route, and during this time the battery is boosted at five times its normal rate. In this way a car averages between 210 and 220 miles per day and practically no time is lost in storing energy. This installation has been so successful that additional equipment has been ordered and the length of the line is to be doubled. On the Chesapeake & Ohio Railroad a storage-battery car is operated an average of 286 miles per day, the battery being charged five hours each night and boosted from time to time during the daylight hours.

In conclusion, the paper reviewed noteworthy results secured by the battery in laboratory short-circuiting tests after accidental immersion in sea water and under conditions of extreme high and low temperature. About fifty electric trucks are now in operation in the Philippine Islands under adverse climatic conditions, and instances were cited of continuous battery operation with satisfactory service at from 35 to 40 deg. below zero Fahr. at Winnipeg, Man. The cold weather question has become one of the easiest with which the battery user has to contend, and its answer is now a simple matter of design. Recent runs on the road of vehicles equipped with such batteries indicate that the day is not far distant when with frequently spaced charging stations cross-country touring within a considerable radius will become highly popular.

In response to a question the author stated that the electrolyte will freeze at from 20 deg. Fahr. to 25 deg. Fahr. below zero.

BATTERY-CHARGING APPARATUS.

Mr. Robert E. Russell, of the General Electric Company, read a twenty-four-page paper illustrating the various types of charging equipment now on the market, and outlined the application of these to the service of private and public garages of various sizes. Much suggestive information was given in connection with specific recommendations for actual service, with advice upon the selection of rheostats, choice of panels, motor-generator sets or rectifiers, and the relative advantages of each under different conditions. High efficiency, low first cost and minimum occupancy of floor space are important. In conclusion emphasis was laid upon the vital importance of supplying the manufacturer with adequate information in seeking specific recommendations.

Discussion.

Messrs. E. S. Mansfield, Boston; W. E. Holland, Boston, and R. L. Lloyd, Philadelphia, spoke briefly. The Boston Edison Company's practice favors the use of the rectifier instead of the motor-generator set, on account of its efficiency at varied loads and its lower cost. Mr. Lloyd spoke highly of the efficiency of a battery-charging converter lately placed on the market. In response to inquiries, the author stated that where alternating and direct current are supplied at the same price, for charging, say, thirty cells, a battery-charging rheostat and panel for direct-current service would be advised. The largest rectifier made is rated at 50 amp. In the great majority of cases the tube life is satisfactory, a guarantee of at least 600 hours being given, while in many cases a life of 2000 hours has been obtained. A study is being made at the factory of the possibility of mounting tubes in multiple on a single panel. A rectifier is now available which gives a constant current for Edison battery service. Pulsating currents should be measured by the permanent-magnet type of instruments.

STARTING DEVICES FOR ALTERNATING-CURRENT MOTORS.

Methods Employed in Minimizing the Starting Current and Voltage Fluctuation in the Supply System.

By William E. Kampf.

With the present practice of distributing alternating-current energy from transformer to common secondary to supply a group of nearby customers, particularly a mixed lighting and motor load, it is important that the voltage regulation at the secondary be as good as possible in order to avoid any fluctuation at the lamps. In addition to installing wires of sufficient size to meet present and future demands, attention must be given to the starting current of the motors in use. One of the many ways of guarding against abnormal inrushes of current is the installation of the proper type of motor to drive the apparatus, particular attention being paid to the starting torque. Another important factor is the type of starting device employed. It should be of such a design as to limit the starting current taken by the motor to a low value. The latter requirement, the writer believes, has not had sufficient attention.

AUTO-TRANSFORMER STARTERS.

Two-phase and three-phase motors of the squirrel-cage type are frequently started by means of an auto-transformer which resembles an ordinary core-type transformer except that there is only one winding. Two-phase auto-transformers are provided with two coils, one for each phase, to give balanced starting current. For three-phase starters only two coils are used, the unbalanced current being of no importance. From the winding of each coil a number of taps are taken off to give a reduced potential at motor terminals. Provision is made for a double-throw switch so arranged as to increase the starting voltage at the motor to the full line potential and simultaneously disconnect the auto-transformer.

The older type of auto-starters consisted of an auto-transformer inclosed in an iron case with the double-throw switch mounted on its face. The double-throw switch in

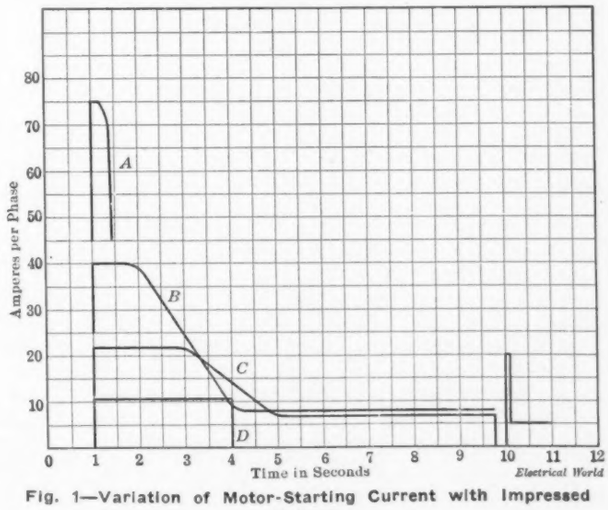


Fig. 1—Variation of Motor-Starting Current with Impressed Voltage.

more recent types is immersed in oil and is equipped with sliding self-wiping contacts and spring-return attachments to prevent the auto-transformer being left in the starting position, since it is designed for starting duty only. Means are provided for compelling the operator to use first the starting position and then the running position.

Taps are provided on auto-transformers to deliver a certain percentage of the line potential at the motor terminals. The use of a lowered emf is desirable to provide sufficient voltage to accelerate the motor. The accompanying table illustrates the effect of reducing the voltage on the torque and starting current. From this it is evident that full-load starting torque will be developed in the motor with 70 per cent of line potential, which on a 220-volt motor

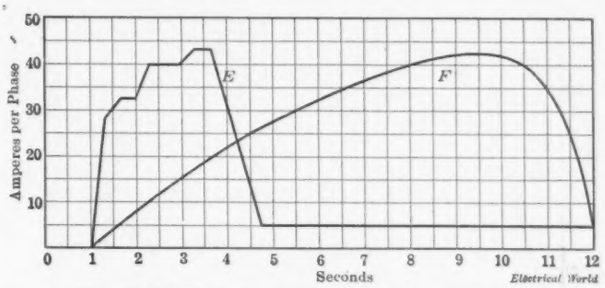


Fig. 2—Starting Current with Series Resistors.

would be 154 volts. The range of taps for motors up to 25 hp should be from 10 to 15 per cent above and below 70 per cent voltage; for large sizes, in order to avoid a large inrush current, the lowest tap should be 30 per cent below 70 per cent voltage with other taps in between.

A test was made on a 5-hp, two-phase, squirrel-cage motor by means of a recording ammeter to determine the starting current required when the motor was connected directly to the line and when various auto-transformer taps were used. The motor was located in a machine shop, driving about

EFFECT ON TORQUE AND STARTING CURRENT OF REDUCING VOLTAGE.

Per Cent of Line Volts at Motor.	Motor-Starting Current in Per Cent of Full-Load Current.	Starting Torque in Per Cent of Full-Load Running Torque.	Starting Line Current in Per Cent of Full-Load Current.
40	280	32	112
60	420	72	252
70	490	98	343
80	560	128	448
100	700	200	700

75 ft. of 1-in. line shafting belted to a number of small machine lathes and drill presses. Normally the shafting alone would be started, after which the load would be operated. Referring to Fig. 1, curve A shows starting current taken with no load on motor, thrown directly across the line; curve B, with shafting load and auto-transformer on 80 per cent tap; curve C, shafting load and 65 per cent tap; curve D, shafting load and 50 per cent tap. The odd shape of the last curve is the result of the voltage not being sufficient to start the load. These curves serve to illustrate the large current taken when the motor is used without an auto-transformer, the value being from five to seven times full-load current, and to demonstrate the advantage of reducing the starting current by the use of an auto-transformer.

Some makes of induction motors are equipped with additional turns connected in series with the primary winding. In starting the motor use is made of a double-throw switch so arranged as to disconnect the extra starting winding when the motor has attained full speed. The starting current can be reduced to 175 per cent of the full-load value by adding a sufficient number of turns.

RESISTOR STARTERS.

Squirrel-cage alternating-current motors can be started by the use of resistance, as is common practice with direct-

current motors. Wire-type resistor starters have been developed in which resistance is inserted in each phase and gradually cut out to accelerate the motor. An improvement over the wire resistor starters is the graphite resistor, which consists of graphite disks inclosed within a heat-resisting porcelain-lined iron tube. As the disks are compressed, the resistance of a pile of these disks is decreased, thus causing

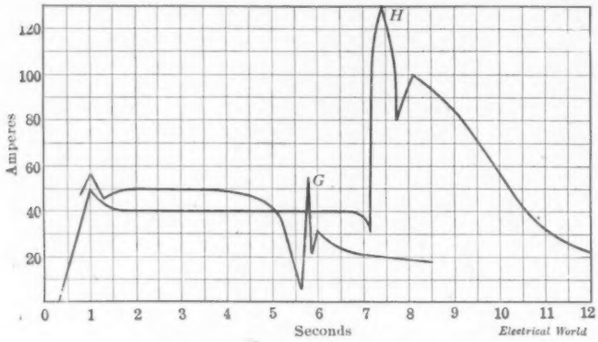


Fig. 3—Starting Current of Split-Phase Motors.

the motor voltage to rise gradually until the motor has reached full speed, when the resistor is short-circuited. One advantage of this starter is the absence of arcing contacts.

In Fig. 2 are plotted the results of a test on a 5-hp two-phase motor. Curve E shows the current inrush with wire-resistor starters. The load started was nearly the same as in the previous test, with the exception that instead of 75 ft. of shafting there was 50 ft. Curve F represents the inrush of current with graphite resistor starter. This test here illustrated was made by removing the auto-transformer and substituting the graphite resistor. Evidently more power is required to start the same load with a resistor than with an auto-transformer.

Slip-ring or wound-rotor motors are always started by inserting resistance in the secondary circuit. The resistors may be mounted on the rotor or external to it, depending upon whether the duty is intermittent or continuous. Slip-ring motors are particularly adapted to starting heavy loads with a minimum amount of current.

Among the many factors entering into the question of minimum starting current the most important is the selection of the proper type of motor to drive the load. For heavy loads and variable speed use should be made of slip-ring motors. Where the line shafting is equipped with a friction clutch or loose pulley use can be made of squirrel-cage motors provided with an efficient motor starter. In cases where the motor is started frequently the auto-transformer is more reliable than the resistor starter because the inrush current can be limited by selecting the proper tap connection on the auto-transformer, whereas with the resistor starter the current is not limited, and if the handle of the starting box is moved directly to the line contact before the motor reaches full speed the current may reach as high as seven times the full-load value. On the other hand, if the handle is pulled over too slowly the resistor becomes very hot and may burn out. With the graphite resistor starter the motor can be accelerated more slowly because of the high-heat storage capacity of the graphite disks. This fact, however, is offset by the rapidity with which the compression lever or switch can be operated to start the motor. The proper service for resistor starters is in starting very light loads infrequently.

SPLIT-PHASE STARTERS.

In central-station work economy of service occasionally demands the use of single-phase motors, particularly when the motor installation is at a considerable distance from two-phase primary or secondary supply. With the motor load considerable lighting load will invariably be found, and hence close voltage regulation is required. Single-phase motors can be classified conveniently according to the method of starting. To start single-phase induction motors, currents differing in time-phase must be obtained to produce a rotating field. This result is accomplished by providing two windings on the stator, separated sufficiently in electrical space position and having different ratios of resistance to reactance. The stator can be equipped with two similar windings, and difference in resistance and reactance may be obtained by external means. In any event an automatic centrifugal device disconnects the starting circuits, and the motor runs as a single-phase induction machine. For mechanically smooth starting the rotor is equipped with a clutch pulley which accelerates the load from rest to full speed. In Fig. 3 are shown the results of tests made on two 5-hp motors of the above types. Curve G represents the current inrush with an external split-phase starter, and curve H the inrush with an internal split-phase starting device. The second peak in curve G occurs at the moment the clutch pulley begins to accelerate the load. The high peak in curve H is the current taken at the instant the starting winding is disconnected and the clutch pulley starts the load.

COMMUTATOR STARTERS.

Mention should also be made of the repulsion type of single-phase motor which resembles a direct-current machine. During the starting period carbon brushes cross-connected temporarily short-circuit the armature in one direction, these producing a magnetic field in the rotor at an angle with the primary field in the stator, a high starting torque being developed by the repulsion between the two magnetic fields. When the motor has reached full speed the commutator segments are short-circuited by means of an automatic centrifugal switch which converts the machine to an induction motor. When used with a repulsion motor a starting resistor serves to smooth out the high current peaks. Curve I of Fig. 4 shows the starting current of a 15-hp repulsion motor without a starting resistor, while curve J indicates the current demanded with a resistor. The brushes are short-circuited at the second peaks. At the top of the illustration are shown the corresponding voltage curves, which indicate the service voltage regulation.

The operating characteristics of starting devices and motors bear a definite relation to the quality of service rendered, and in view of the present-day policy of pleasing the public they should command the attention of electric

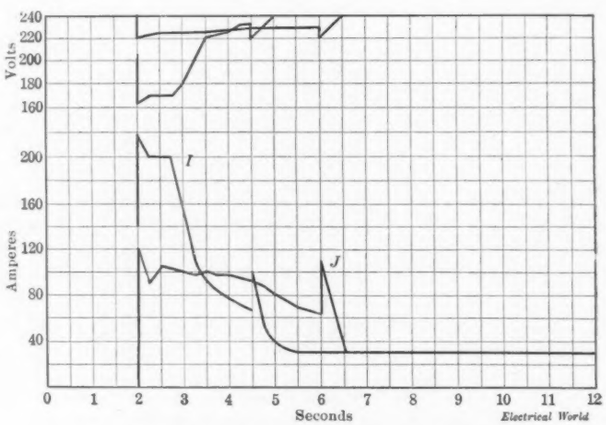


Fig. 4—Starting Current of Repulsion Motor.

lighting companies. The writer is of the opinion that some sort of supervision should be exercised over the motor installations rated at 5 hp and above. The use of current-limiting devices should be encouraged on small motor installation. Only such starting devices as effectively limit the starting currents and are foolproof and reliable should be accepted.

Central Station
Management, Policies and Commercial Methods

REPLACING AIR LIFT WITH DEEP-WELL PUMP.

For supplying the water used in a large Western manufacturing plant a 200-hp compressor set was formerly required to operate the air lifts in the wells. Since central-station service has entered the plant this compressor has been replaced by a 25-hp motor-driven deep-well propeller pump, which now furnishes as much water as did the larger air equipment. In addition to the superior efficiency of the deep-well pump, the former lift was saddled with befouled screens, which reduced its output. Accurate knowledge of what motor drive could do, however, enabled the central station to close the business. The new propeller pump lifts 450 gal. per minute from a pumping level of 80 ft. Other pumps then deliver this output to the reservoir against a filter head of 170 ft., or 250 ft. in all. The consumption has averaged about 2 kw-hr. for each 1000 gal. handled.

SHORT-SIGHTED APPLIANCE CAMPAIGNS.

One of the pioneers in the electric-heating-appliance business, in discussing the growing use of electric heating appliances, recently said that sales of appliances have shown a wonderful increase this year. Of the many varieties of appliance handled by the concern with which he is associated the toaster seems to be in greatest demand. He attributes this to his belief that the toaster is a self-advertising device, as it constantly attracts the notice of visitors to a household and its merits thus become a topic of conversation even after its novelty has ceased for the owner and the latter has tired of calling attention to it, as is done so often when it is first placed in use. The electric iron, on the contrary, being kept in the kitchen, escapes notice, is disregarded in a short time and comes in for attention only when it gets out of order. He believes that the central stations will ultimately recognize the greater advantages of the toaster as a publicity agent and will promote it to a much greater extent than they will the iron.

Many of the central-station companies, he feels, are short-sighted in their attitude toward the sale of appliances. Sales managers of central-station companies, of course, realize that the primary object of handling appliances is to increase the amount of revenue from the sale of energy, but he finds that many of those in charge of appliance departments are not so careful as they should be to recommend high-grade appliances that will give satisfaction to the user, hold and stimulate his interest and will thus continue to be a source of additional revenue to the central-station company. In other words, it should be impressed upon the appliance salesman that the company is not handling the appliance for the small profit from the sale of the appliance itself.

Central-station companies should pay more attention to following up appliances after they are sold, to see that they are kept in repair and in operation, for the owner frequently gets discouraged when the appliance fails to work, neglects to have it attended to, discards it, and the primary object of the sale, from the central-station viewpoint—the use of energy—is defeated. When a customer brings an appliance in for repairs he should receive every possible attention, since he shows by this act that he is interested in the appliance and wants to continue using it.

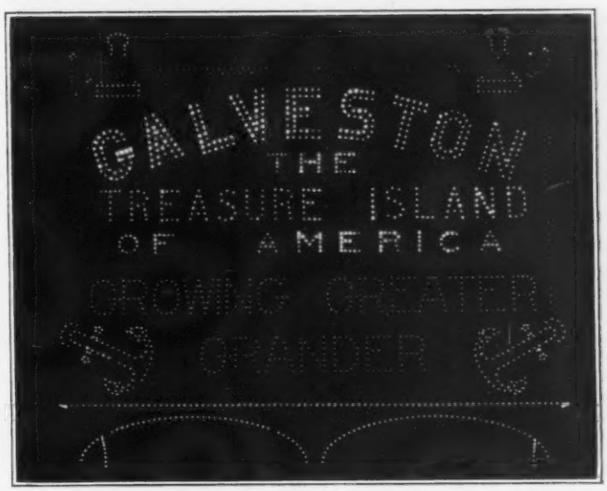
Too many central-station companies undersell the local dealers to make harmonious relations possible. Unless more careful thought is given to the matter of providing fair profits for everyone, neither the central-station company, the manufacturer nor the dealer is going to enjoy all the benefits that are offered in this field. Price-cutting, this manufacturer says, is the greatest drawback in the advancement of the appliance industry at present, and he feels that there is urgent necessity for jobbers, contractors, dealers, manufacturers and central-station companies to get together and agree upon a fair basis for handling electric heating appliances.

COST OF OPERATING ELECTRIC SAND PUMPS.

A profitable long-hour use for motors is the operation of sand pumps dredging river bars and loading the sand and gravel into railroad cars. This method of handling the material is simple and economical for the customer and by its steady character contributes to improving the central-station's load-factor. The Topeka (Kan.) Sand Company operates an 80-hp, 600-volt direct-current motor driving an 8-in. centrifugal pump which handles a mixture of sand and water, transferring it 150 ft. horizontally with a vertical lift of 40 ft. Service is furnished by the Topeka Edison Company under an optional rate of 5 cents per kw-hr. without minimum charge, or 3 cents per kw-hr. with a minimum of $1.50 per hp per month. In a recent test of this equipment twenty cars were loaded with 915 tons of sand, each car averaging 45.75 tons. A total of 530 kw-hr. was consumed, which is equivalent to an expenditure of 580 watts for each ton of material handled.

CITY ADVERTISING BY CENTRAL STATION.

A large "slogan" sign containing more than 5000 5-watt tungsten lamps has recently been erected in the city of Galveston, Tex. It is of steel framework, 75 ft. high and 50 ft. wide, placed on a foundation of ornamental concrete, the latter being 30 ft. high. The sign, which is built on the seawall, facing the main thoroughfare, is a gift of the



"Slogan" Sign of the City of Galveston.

Brush Electric Company to the city of Galveston and forms part of the lighting campaign inaugurated a few months ago to make Galveston "the best lighted city in the world." The cost of the sign is $10,000, and it will be maintained and operated by the central-station company without cost to the city.

Crowning the sign at each upper corner is a ship's

capstan 8 ft. high and 5 ft. wide at the base. At each lower corner is a ship's anchor, the anchor shaft being 11 ft. long and the spread from tip to tip being 8 ft. The entire sign is surrounded by two cables, each 1 ft. in diameter. The two capstans are studded with red and green lamps, the ropes outlining the sign with amber-colored lamps and the anchors with brilliant red lamps. The accompanying illustration shows the wording of the sign, the lower portion "Growing Greater, Grander" being replaced intermittently by "Port and Playground." The letters vary in sizes from 5 ft. to 10 ft. The sign was built by the Valentine Electric Sign Company of Atlantic City, N. J.

In the last six months more than 150 electric signs and outlines of buildings, containing from 100 to 1000 lamps, have been erected at Galveston. Mr. A. K. Young is the commercial manager of the Brush Electric Company, which is owned by Henry L. Doherty & Company, of New York.

ELECTRIC LIGHT COMPANIES AT NEW YORK ELECTRICAL SHOW.

In the New York Electrical Exposition and Automobile Show, held in the New Grand Central Palace, Oct. 9-19,

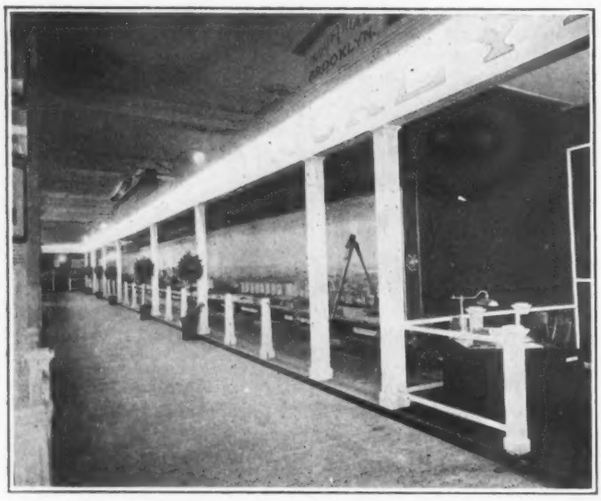


Fig. 1—Exhibit of the Brooklyn Edison Company.

six of the electric light companies in the vicinity of New York were represented.

The New York Edison Company's booths were scattered about the building. By means of photographs, models, charts and diagrams an attempt was made to convey some idea of the magnitude of the work that the company carries on. Forty or more charts showed the growth of the company during the past thirty years. Another exhibit showed how complaints are handled and explained some of the factors that cause fluctuations in lighting bills. The advertising methods of the company were shown in part through the issue of a daily newspaper, a complete printing plant for which had been instaled on the mezzanine floor and was employed by the company to demonstrate the use of electricity in a print shop. Night views taken by the photographic bureau were shown, and the illuminating engineering bureau had an interesting exhibit of fixtures and shades. There were also a reception room, an electric tea room and an electric laundry, together with an exhibit of the work of the Edison school, which was established last year for the technical education of the employees of the company. A booth was also given over to a display of samples of the advertising literature of the company. On the ground floor, near the entrance, one of the old Jumbo machines used in the Pearl Street station, thirty years ago, was shown side by side with a model of one of the new 20,000-kw units now operating in the Waterside station.

The United Electric Light & Power Company's booth was split up into four sections, arranged about a large center reception space. The four sections were employed to illustrate the use of electricity in the factory, in the store and in the home. By means of colored photographic plates

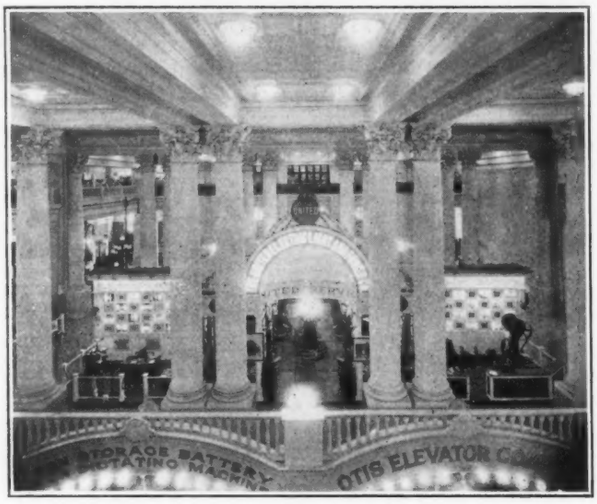


Fig. 2—Exhibit of the United Electric Light & Power Company.

mounted on partition walls, and suitably lighted from behind, many lighting and motor installations were shown. In the factory section there was an exhibition of electric drive and colored transparencies showing motor installations. In the store-lighting section colored transparencies showed several installations made by the company in retail shops, the installations being made under special agreement with the company whereby the cost is met in monthly payments. In one of the two sections devoted to the use of electricity in the home were shown transparencies illustrating the method of wiring already built houses without defacing the walls, floors or ceilings.

Fig. 3—Exhibit of the Advertising Bureau of the New York Edison Company.

The Edison Electric Illuminating Company of Brooklyn featured in its exhibit the industrial advantages of Brooklyn. For this purpose the greater part of its section, which occupied one side of the main floor, was given over to a panorama, 100 ft. or so in length, of the waterfront of Brooklyn. All of the enterprises on or near the waterfront were reproduced in miniature, and the streets, homes and

public buildings were shown in the background. The color and lighting effects added to the attraction of the picture. Large concerns in the borough using the service of the Brooklyn Edison company were named by placards fastened to the front of the panorama, and in other sections of the space devoted to reception purposes there were drawings of proposed improvements near the great bridges. These studies were submitted to the municipality some years ago as part of a great plan for the beautification of the borough's approaches and civic centers.

The Yonkers Electric Light Company showed a map of the city which uses its service, on which were depicted its circuits. Photographs of Yonkers homes and factories, night views of the streets of the city and curves showing the growth of the electric service were also displayed.

The Westchester Lighting Company maintained a comfortable reception room for visitors from the towns of Westchester County. An interesting display was made of photographs of electrical installations, and in the background of the both was a huge star, at the points of which were the names of the various communities in the 298 square miles of territory served by the company.

The New York & Queens Electric Light & Power Company's purpose had been to "boost Queens," and to this end maps, photographs and stereopticon slides were shown in the reception space maintained by the company. Among the views were a number of factories, some of the fine residences and some of the home-site developments with which the borough of Queens abounds. A map of the city arranged to show the relative size of Queens compared to that of the other boroughs served to emphasize the close proximity of all parts of the borough of Queens to the hub of Greater New York.

CO-OPERATIVE STREET LIGHTING IN DES MOINES.

An interesting arrangement has been entered into in Des Moines by which the city agrees to pay for the operation of the top lamps on curb-lighting posts from dusk until midnight, the energy used between midnight and dawn by the same lamp being donated by the Des Moines Electric Company. During the last four years the electric-service company, assisted by "booster" organizations, has put in position in Des Moines 440 curb-lighting posts supporting five 100-watt tungsten lamps in translucent white-glass globes. One of these globes surmounts the post and four are suspended from brackets. The original arrangement was that merchants or abutting property owners should pay the electric-service company for posts and equipment at the rate of $60 for each post, with an operating and maintenance charge of $5.80 a month per post. In the event of failure to pay the monthly charge the electricity was cut off, and the number of posts supporting burning lamps on Oct. 1 last was reported to be 342.

In July last the retail merchants started a movement designed to cause the city to take over the 440 electroliers and pay for their operation and maintenance as street lighting. They were not successful in securing all they asked for, but they did obtain a substantial reduction as the result of an agreement by which the merchants, the city and the company agree to share the burden. The initial cost of the installation of new posts, $60, remains as before. However, the city agrees to pay $12 a year for the lighting and maintenance of each top lamp from dusk until midnight. The cost of this service from midnight until dawn is assumed by the company. The merchants agree to pay $43.68 a year, or $3.64 a month, for the operation and maintenance of the four other lamps from dusk until midnight. The posts are spaced 44 ft. apart, so that the cost to each merchant having 22 ft. frontage is only $1.82 a month. The electric-service company's total revenue from each post, operating the lamps as related, is $55.68 a year. In order to get revenue to pay for the top lamps on the curb-lighting posts, the city will discontinue entirely the ordinary street-lighting arc lamps at street intersections in the districts affected. After midnight the street lighting will be confined entirely to these top lamps, which are thought to afford sufficient light for the purpose.

DIRECT ADVERTISING IN A SIGN CAMPAIGN.

During an October "home-coming week" in a Kansas town, while everyone was busiest, the central-station company created some excitement and valuable publicity for itself by dispatching uniformed messenger boys with imitation telegrams to all the local business men. The messengers carried regular receipt books and solemnly required each addressee to sign for his sealed envelope, so that receipt and perusal were in each case assured. The "message" explained the company's plan for brightening up the main street with ornamental lighting and electric signs: "Light and sales go hand in hand," it read. "Light holds the public's attention and means sales, and sales mean profits. If between dusk and midnight one person per minute passes your store the total number will reach 131,400 in a year. We are going to call on you and go into details."

ELECTRIC DELIVERY WAGON FOR GROCER.

In all of the large cities of the country the electric delivery wagon has thus far been used chiefly by large department stores and express companies, and it has been somewhat difficult for electric-light companies to convince other users of horse-drawn vehicles, especially the corner grocer, that it is just as advantageous and economical to use one, two or three wagons as it is to use fifty or 100 wagons. In either case the electric vehicle will cover at least double the ground of the horse-drawn wagon, will carry heavier loads, is much cleaner and easier to care for, and is far more independent of weather conditions. In addition, there is a distinct advertising value to an electric delivery service. The Edison Electric Illuminating Company of Brooklyn has on its circuits one grocer who realizes

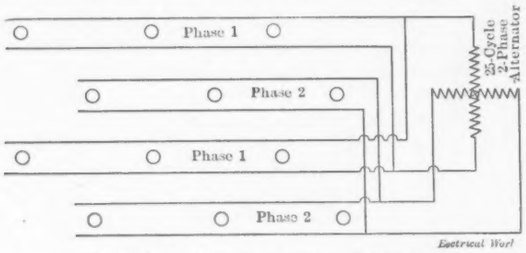
Light Electric Delivery Wagon.

and takes advantage of these facts. Some months ago this merchant purchased the electric delivery wagon shown in the illustration. It is kept in his garage at the rear of the store, where a 50-amp outfit is installed for charging purposes. The grocer is said to be more than satisfied with the results obtained and to consider his electric wagon not only an attractive feature of his business but an investment.

Wiring and Illumination

LOW-FREQUENCY FLICKER CURED BY TWO-PHASE WIRING.

In a large manufacturing establishment near Pittsburgh the shop offices are lighted from the 25-cycle plant lines. At this low frequency the 40-watt tungsten lamps used gave considerable annoyance from flickering. The units were hung low, and at the high intensities on the working surfaces this flicker became very objectionable. The trouble has



Method of Wiring to Avoid Flickering.

now been practically cured, however, by connecting half of the twenty lamps to the second phase of the two-phase supply system. The individual flicker of each group is thus neutralized by the coincident "peak" of the other lamps, and the total illumination on any lighted surface is practically uniform. On examination, of course, the flicker of the individual lamps can still be detected. The second phase was, in the case cited, easily accessible, and the division of the load, besides curing the flicker, has resulted in a better balance.

VANCOUVER ILLUMINATION IN HONOR OF VISIT OF GOVERNOR-GENERAL OF CANADA.

The visit of His Royal Highness the Duke of Connaught, Governor-General of Canada, and his party to Vancouver, B. C., Sept. 17 to 21, was the occasion of a public celebration

Fig. 1—Night View of Hastings Street, Vancouver, During Governor-General's Visit.

which evidenced the loyalty of the citizens of the metropolis of the Canadian Pacific Coast. Electrical illuminations played a prominent part in this celebration, which continued over the five days. The most prominent single installation was that at the new office bui'ding of the British Columbia Electric Railway Company on Hastings Street, in the center of the city, to outline which required over 5000 lamps. For the outline stringers 4-cp lamps were used, and the effectiveness of the display was greatly increased by a row of 40-watt tungsten lamps located on the coping of the cornice of the upper story, these forming a part of the permanent wiring of the building. On the ground floor the building was surrounded by a row of twelve regenerative-flame arc lamps, which were placed between each of the arches on

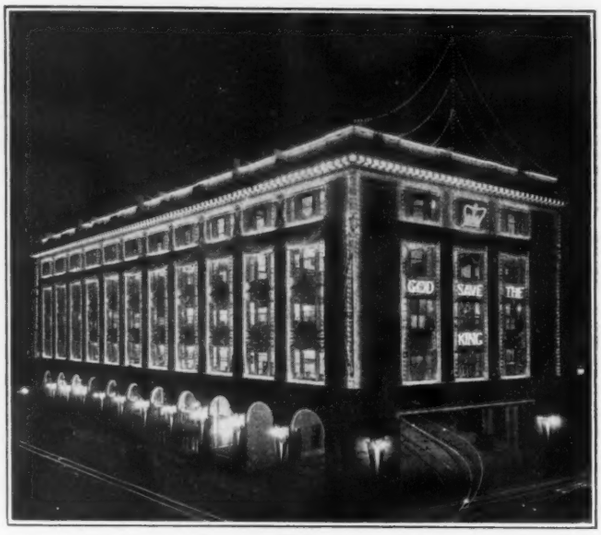


Fig. 2—Illumination of British Columbia Electric Railway Company's Building for Governor-General's Visit.

the street frontages. On the Hastings Street side of the building a crown in which 200 lamps were used, some being in color, and "God Save the King" in letters 2 ft. high, made an effective addition to the display.

In the business section of the city twelve triumphal arches were erected by various public organizations, most of which were illuminated at night, the British Columbia Electric Railway Company furnishing energy free for that purpose. A view of the illuminations on Hastings Street from Granville Street is shown in connection with this article. The illuminated arch shown in the lower right-hand corner was located on Granville Street at the head of the incline leading from the Canadian Pacific Railway station and docks. It was the welcome arch of the city. The large building in the left foreground is that of the Canadian Bank of Commerce, and the arch on Hastings Street in the center of the picture is that of the Canadian Northern Railway, through which may be seen the lamps on the largest of the arches, that erected by the Italian residents of Vancouver. The Hastings Street view gives some idea of the illumination prevailing in Vancouver during the nights of the Governor-General's stay.

PROPOSED "WHITE WAY" LIGHTING IN MOBILE.

It is planned to provide ornamental curb lighting for a distance of about 2 miles on Government Street in Mobile, Ala. This is the principal residence street of the city, and the idea is to have the new "white way" lighting extend from Conception to Catherine Street. It is proposed also to extend the ornamental curb lighting into the downtown district. Both of these systems will be an elaboration of the "white way" lighting in Bienville Square, which was installed some time ago through the efforts of the Mobile Electric Company. Tentative plans for the curb lighting of Government Street require the installation of 170 five-lamp posts, to be 133 ft. apart, with four standards at each street intersection. The estimated cost of the new lighting on Government Street is $30,000.

JOINTS FOR TUBULAR STEEL POLES.

Considerable information on tubular steel poles was presented by Mr. W. T. Snyder, electrical engineer for the National Tube Company, McKeesport, Pa., in a paper read before the Association of Iron and Steel Electrical Engineers at Milwaukee on Oct. 3. Referring to the practice of jointing poles, Mr. Snyder said that from the manufacturer's point of view the length of sections employed in any pole is immaterial, provided the pole is composed of some combination of the standard section lengths. These lengths have been selected to give light-weight poles for the strength and stiffness required, without unnecessarily increasing the cost of manufacture. Poles made up of other section lengths are "special," usually entailing considerable scrap and materially increasing the cost.

Joints between sections are made by inserting the smaller pipe 18 in. into the larger pipe while the latter is at a red heat, swaging down the heated portion and then allowing the joint to cool and shrink. The swaging to reduce the diameter is done either in a hydraulic press or under a hammer. This joint, usually assembled in the manufacturer's shop, is called a shop joint, and is shown in Fig. 1.

For shipment of poles over 40 ft. long two railroad cars are generally required, so that at times it is economical to make the poles in two parts, with one joint fashioned for the customer to assemble at the point of erection. Such a field joint is shown in Fig. 2. This joint is slightly tapered

Fig. 1—Shop Joint.

Fig. 2—Field Joint.

to allow easy insertion when assembling in the field. For this it is only necessary to have the two parts accurately in alignment, the lighter one being on rollers, so placed that it may be moved endwise without disturbing the alignment. The outside end is then heated for 18 in. to a red heat and the smaller pipe inserted and allowed to cool.

To determine the mechanical resistance of the swaged joints a number were cut from poles of medium-sized pipes and subjected to endwise pressure to determine the force that would start telescoping. A load of from 30 tons to 40 tons would often fail to start the joints. This is twice the load the pipes would be expected to support as a column without joints.

Experiments also show that the telescope joints have no effect on lateral strength, stiffness or set of poles, provided the joints are made with sufficient insertion. These experiments were made by testing simple pipes of various sizes and lengths up to 40 ft. On comparing the results with those of jointed poles, it was found that deflection measures gave about the same average value of the modulus of elasticity with and without joints, also that deflections computed, allowing for the double thickness at joints, did not check as well with test results as when the sections were each considered uniform from point of emergence. Crippling never occurred in the joints, but always in the pipe where strain was greatest.

It is advisable to put caps on the tops of tubular poles to keep rain from filling them with water. Wood arms should be used for the safety of men working on live lines, enabling them to insulate themselves from ground.

SPECIAL ILLUMINATION AT LEBANON, PA.

At a recent convention held in Lebanon, Pa., by the Pennsylvania State Firemen's Association the general committee, as well as the citizens of the city, spent considerable money

Fig. 1—Court of Honor on Ninth Street, Lebanon.

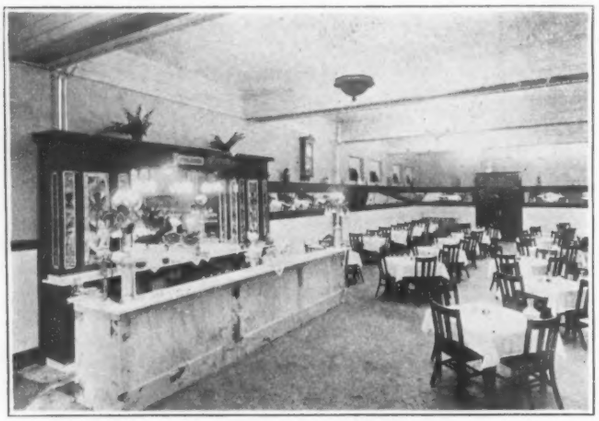
in producing appropriate decorations for the occasion. The electrical illuminations were especially elaborate in the business section of the city, where there was a connected load of about 250 kw. The Edison Electric Illuminating Company sold the energy at a rate of 6 cents per kw-hr., but made no charge for the loan of the lamps. However, it supplied the various fire companies of the city with lamps and energy gratis. When it is remembered that Lebanon is a city of about 20,000 inhabitants, the display was certainly a creditable one. Views of the Court of Honor on Ninth

Fig. 2—Cumberland Street, Lebanon, During Firemen's Festival.

Street, where 1200 lamps were installed, and also of Cumberland Street, are shown herewith. The latter thoroughfare contains the office of the electric light company, which was appropriately decorated during the week. Mr. Douglass Ford is in charge of the commercial department of the company and Mr. H. G. Louser is superintendent of the Edison company at Lebanon.

INDIRECT LIGHTING IN A CONFECTIONERY SHOP.

The photograph reproduced herewith is the result of a forty-five-minute exposure made with the indirect-lighting installation in Fulsom's bakery, confectionery and restaurant at Lincoln, Neb. This room, approximately 45 ft. by 75 ft., is lighted by ten 20-in. bowl fixtures, each containing a



Indirect Lighting in a Confectionery Shop.

250-watt tungsten lamp. The bowls are suspended 30 in. below the 12-ft. ceiling, which is tinted a very pale blue. Except for the ornamental art-glass fixtures on the soda fountain, the indirect lighting is relied upon entirely for the illumination of the room.

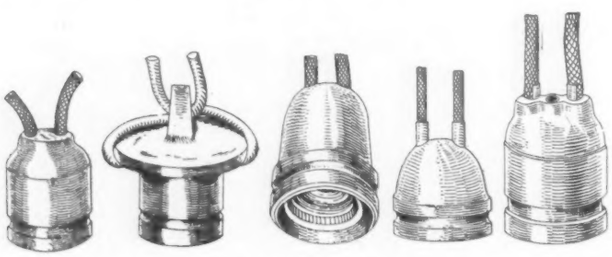
CONDUIT VERSUS OPEN WORK IN PLACES SUBJECT TO MOISTURE, CORROSIVE FUMES, STEAM, ETC.—III.

By F. G. Waldenfels.

In previous articles were described the general conditions relating to electrical installations in packing houses, breweries, tanneries and other places subject to the influence of moisture, corrosive fumes, heat, salty atmosphere, steam, etc. Certain details regarding wiring of such places were also described. Other phases of the subject are treated in the present instalment.

SOCKETS.

The choice of sockets is more or less a gamble. Porcelain weatherproof sockets are fragile and cannot stand rough usage, for reasons too numerous to mention. Many porcelain sockets can be found broken six months after they have been installed, because moisture runs down the wires into the top of the socket and with the assistance of heat finally cracks it. On many types of porcelain sockets formerly used a sulphur compound was used for sealing purposes, and this when moistened caused the socket to crack as soon as there was a change of temperature. The newer sockets have a more durable filling compound which will not crack the socket when subject to moisture and heat.



Figs. 16-20—Weatherproof and Vaporproof Sockets.

COMPOSITION AND MICA SOCKETS.

For high ceilings in wet places, where the drop lamps are out of reach, composition and mica sockets have lasted very well. There is no sulphur used in these sockets for sealing purposes, and therefore they do not crack open easily; but, on the other hand, excessive heat will melt them. On low ceilings, however, pigtail sockets should not be used, because of the twisting of the joints due to the practice of switching the lamp on and off by turning it in the socket. The hard-rubber molded or mica sockets, however, are best and cheapest for use on reasonably high ceilings in wet places. They will not crack like porcelain sockets, can withstand extra hard usage and are constructed even better than the vaporproof socket by having a solid body of composition supporting the shell. In extremely hot places porcelain sockets are preferable, however, for the reason stated before.

VAPORPROOF SOCKETS.

Vaporproof sockets give fair results if the outer globe is always on and if they are not exposed to mechanical injury. They cannot withstand any hard usage, however, and this is a requirement which generally must be fulfilled in steamy places. The main trouble is that the screw shell is not properly surrounded with a porcelain body, and the bare shell is too weak for ordinary use.

CONDUIT BOX SOCKETS.

Rigid weatherproof sockets when installed in outlet boxes give satisfaction, especially on low ceilings where the employees habitually extinguish the lights by turning the lamps in the sockets. The porcelain part of the socket should be notched and fitted into a notched metal cover to prevent the socket from turning. Of course, where the ceilings are high and the lamps controlled by switches are out of reach the drops are not so objectionable.

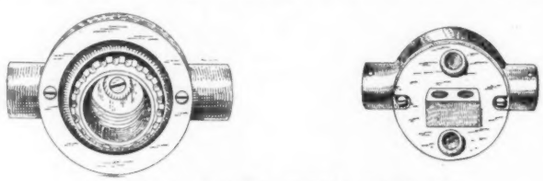


Fig. 21—Conduit Box Socket and Outlet.

On very low ceilings, where rigidly supported lamp and receptacle are impracticable on account of liability to mechanical injury, it is advisable to install conduit with porcelain covers, which permit the use of short pigtail weatherproof sockets, without joints between the lamp and the porcelain cover. Pressed-steel condulets give excellent results because they do not break at the shoulder if there should happen to be a side strain on the conduit, although they frequently crack in the seams. For protection against moisture and corrosive fumes, however, the cast-iron outlet box or condulet has not been excelled. There is, however, a sherardized steel condulet and outlet box on the market that has given good results in such places. When lamp sockets are empty it is wise to plug them with a tight-fitting cork to keep them from corroding.

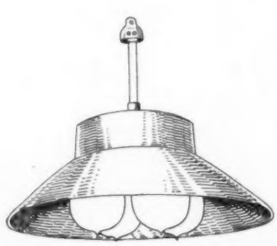


Fig. 22—Weatherproof Ceiling Cluster.

CLUSTERS.

During the last few years waterproof clusters have been employed to great advantage where the ceilings are at least of medium height. Clusters that have given the best results have been equipped with an enameled shade. They are made up with a ½-in. pipe stem about 12 in. long and are fitted with a porcelain body for the lamp receptacles, or with individual sockets protected by a white enameled shield, which permits the sockets to project through it about ¼ in. Extensions can be attached to these clusters without harm. The clusters are generally hung from a hook in a swinging position—a very favorable feature. Where corrosive vapors abound, however, it has been found that the ordinary iron hook corrodes, and in such places it is advisable to suspend the clusters from malleable-iron or cast-iron hooks.

Another method of hanging a cluster so as to allow it to swing in two directions only is shown in Fig. 23. Here two pieces of pipe fastened to a T-condulet are strapped to two floor joists and the pipe stem of the cluster is screwed into the condulet.

INCANDESCENT LAMPS.

The type of incandescent lamp in general use has an Edison, or screw, base, but the T-H, or bayonet, base lamp has given the least trouble. As a protection to life the T-H-base lamp is the safest to use in wet places, because there is no live screw shell to come in contact with as in the case of an Edison-base lamp, in which the shell is continued from the socket to the lamp and very often projects beyond the socket about ¼ in. The projecting shell is fraught with danger to employees, especially where 220-volt alternating-current circuits are used for lighting. It is unfortunate that the manufacturers of the T-H base lamps have discouraged their use by raising the price in their determination to force the use of the Edison-base lamp for all purposes. Rather than pay the extra 3 cents per lamp several packing plants have switched over to the Edison base by using adapters or have replaced the T-H socket entirely with a weatherproof Edison base socket.

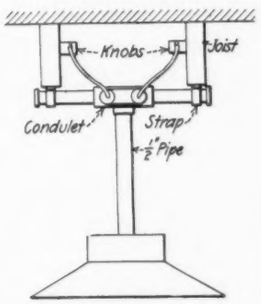


Fig. 23—Method of Hanging Lamp Cluster.

Fig. 24—Vapor-proof Incandescent Lamp.

Fig. 25—Adapter.

ADAPTERS.

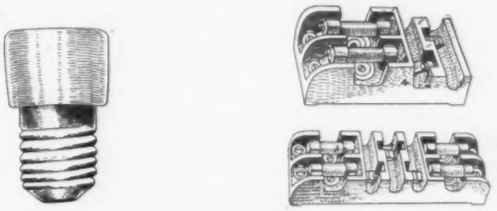
Edison-base adapters have recently been employed where a change has been made from the T-H base lamp with poor results. There are many contributory reasons for this: In the first place the lining of the adapter absorbs moisture like a sponge, causing short-circuits in the sockets; second, if a lamp is unscrewed with the circuit alive the arc holds and burns the thin contact ring in the base of the adapter; third, if in a brass taped and painted key socket equipped with an adapter the circuit to the lamp is interrupted by means of the key, the arc will invariably hold on 220 volts and burn off the metal ring in the base of the adapter.

CUT-OUTS AND SNAP SWITCHES.

On 110-volt circuits the Edison-plug cutouts are very satisfactory, provided the cut-out bases are mounted on ½-in. porcelain knobs, cleats or hard-rubber tubing. Not to mount them would be folly and cause no end of trouble due to the film of moisture which forms between the terminals and the material of the wet cabinet and readily affords a path for the passage of electricity.

CARTRIDGE-PLUG FUSES.

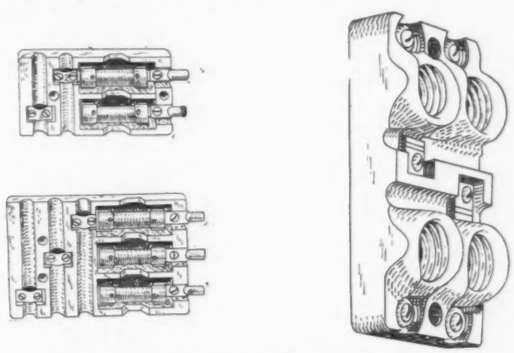
Some electricians prefer the inclosed cartridge-plug fuse, claiming that its use limits to quite an extent any chance of employees getting a shock when the fuses are backed out of the receptacle, because of the large porcelain cap which fits over the plug. Until recently these fuses were approved for use on 220-volt circuits. They were a great deal safer to handle in wet places than the ordinary cartridge fuse of to-day, but one great disadvantage is that an inspector cannot tell the size of the fuse in them.



Figs. 26, 27 and 28—Cartridge-Plug Fuse and Cut-Outs.

CARTRIDGE FUSES.

For 220-volt lighting circuits in damp places cartridge fuses and porcelain bases are required by the Chicago underwriters. The bases should also be mounted on ½-in. porcelain knobs, cleats or hard rubber. Pains must be taken to see that the ferrule contacts fit tightly around the fuse. In this case the inspector must again guess at the size of the fuse in the cartridge. If the cut-out cabinet is tight and well constructed the underwriters would under most circumstances prefer link fuses with copper tips, provided there was a barrier between each set to keep the hot metal from the fused one from reaching an adjacent fuse. Particular pains should be taken to fasten wires under all terminals properly, because a loose contact causes heat and very often melts the fuse.



Figs. 29, 30 and 31—Fuse Cut-Outs.

CARTRIDGE FUSES FOR MOTORS.

Up to 60 amp, 250 to 600 volts, the ferrule-contact cartridge fuse may be used for motors, provided the proper spacings are kept for the different currents and voltages, and from 60 amp to 600 amp, 250 volts, and to 400 amp, 600 volts, the knife-blade contact must be used, provided the proper spacings as specified in the National Electrical Code are followed. These fuses render good service for the motors, but from an inspection standpoint it is difficult to tell what size of fuse wire is in a cut-out that has been

Figs. 32 and 33—Cartridge Fuses with Cut-Out Bases.

refilled without removing it from the base, thereby necessitating the stopping of the machinery to examine it. Concealed fuses create a doubtful feeling in the inspector, and many inspectors would prefer good link fuses to refilled cartridge fuses, provided the cabinets are tight.

On heavy circuits it is imperative to note that all the strands of the cable have been soldered into the lugs which are connected to fuse bases, as it has been found that electricians very frequently cut off the outer strands of a cable to make the latter fit a certain lug. It is also important to see whether cables have been properly sweated into lugs during the soldering process by vigorously shaking the cable near the lug. The defects mentioned cause excessive heating or arcing and are liable to cause fire.

If a heavy fuse blows and another is not at hand it not infrequently happens that the employee places almost any kind of metal across the fuse gap and then replaces the blown fuse over the makeshift, never thinking that the loose contact will cause excessive heating and probably a fire.

LINK FUSES.

Link fuses for lamp and motor circuits, if installed in good, tight cabinets, are the safest and most satisfactory protection that can be employed in packing houses. It is also a very easy matter in such installations for the electrician or the inspector to assure himself that a wire is not

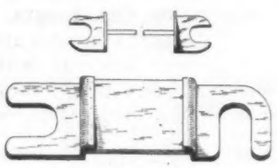


Fig. 34—Link Fuses.

over-fused and that the motors and devices on those circuits are therefore well protected from overloads. Slate or marble bases must be employed for link fuses, and it is advisable to have a barrier across the base between the breaking gap. All link fuses should be provided with copper tips, otherwise a good contact is not made under the screw terminal. With large link fuses it is advisable to note that the proper breaking distance has been maintained across the gap, otherwise if the fuse blows the metal will crystallize across the gap, permitting leakage of current.

In subsequent issues consideration will be given to certain other wiring and lighting fixtures, motors, cabinets, conduits, elimination of condensation in conduits, corrosion and other subjects.

RECENT TELEPHONE PATENTS.

RINGING SYSTEM.

Mr. W. W. Hawkins, of Cleveland, Ohio, has invented a new harmonic system employing unidirectional impulse currents. This permits the use of two selective ringers for each frequency. The usual tuned vibrating system is employed, but the operating coil is mounted on one leg of the permanent magnet. The vibrating armature is also polarized permanently. Where the effect of the coil is such as to increase the normal magnetization of the polarizing magnet no action results, but where the impulses oppose the normal ringing is set up.

INSTRUMENTS AND ATTACHMENTS.

Rather a novel form of receiver has been patented by Mr. W. P. Stuntz, of Lansdowne, Md. The novelty lies in a diaphragm which is not clamped at its periphery but lies upon a circular seat and is held in place by pressure from a stud applied at its center. This stud is fastened to the end of a rocking lever, the outboard end of which carries the armature upon which the receiving coil acts. The deflection of the diaphragm depends upon the pull of the permanent magnet, which in turn is affected by the operating coil mounted upon its pole piece.

Another patent granted to Mr. Stuntz relates to a cooling device for a high-power transmitter. This comprises a hollow mounting block for the stationary electrode of the transmitter, within which cooling fluid may be conducted by inlet and outlet pipes. This will serve to maintain the temperature within the granule chamber practically constant.

The patent granted to Mr. H. W. Schussler, of Philadelphia, describes a receiver-supporting arm and special base for desk stands. A hollow, heavy auxiliary base plate is arranged with hinges to clamp around the base of a desk stand. Rising from this auxiliary base plate is a receiver-supporting arm for holding the receiver at the user's ear. A spring-actuated toggle bar is mounted at a proper height to engage and depress the hook switch. When it is desired to release the hook switch the toggle arm is thrown upward, where it is maintained in a vertical position by its spring.

Letter to the Editors

THE LIGHTING OF CARS.

To the Editors of the Electrical World:

Sirs:—In connection with the car-lighting tests at Washington, D. C., referred to in your issue dated Sept. 28, 1912, the statement is made that the tests of illumination confirmed Mr. J. R. Cravath's conclusions, which, briefly stated, are that less illumination is required from a reflector acting by diffusion than with one depending on regular reflection.

The writer, who was one of the test subjects, can state that the first series of tests did show the aluminized reflector to be superior to others and to require considerably less illumination for reading than the mirrored reflectors. In a second series of tests with the same reflectors and the same test subjects the difference in light required decreased greatly and the results of the individual observers varied so widely that the apparent superiority of aluminized over mirrored glass did not exist. In a third test made at night (with the car attached to a regular train) with the same observers the tests showed the mirrored reflector to be superior to all others in point of amount of illumination required for reading. Unfortunately the writer is not in a position to publish the actual figures of these tests but can say that in the last test made, for illumination just sufficient for comfortable reading, the average of the foot-candles required with the mirrored reflector was 10.7 per cent less than that for the aluminized reflector. For ample illumination that for the mirrored was 7.7 per cent less than that for the aluminized. Clearly no intelligent conclusions can be drawn where results show such wide variation as in the above three series of tests.

Another point worthy of note is that the first two tests of all reflectors were made in the daytime with the car stationary. Contrary to expectations the last series of tests made at night with the car in motion showed that for opal, aluminized and mirrored reflectors less illumination was required than with the car stationary. This seems to indicate a sort of time-lag in the accommodation of the eye, a phenomenon that was apparently overlooked and was not compensated for in the short time allowed for a subject to make his observation after coming from broad daylight into a darkened car. This still further precludes the possibility of drawing conclusions from the results obtained, as it is almost axiomatic that more light should be required on a moving car than on one that is stationary.

Pittsburgh, Pa. Frank T. Leilich.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Three-Phase Commutator Motors.—M. Schenkel.—An illustrated English translation of his German paper recently abstracted in the *Digest,* which contains a general description of the theory, construction and method of working of the three-phase series commutator motor. After discussing the limitations associated with the ordinary three-phase series motor with a single set of brushes, the author passes on to show how the Siemens-Schuckert company has overcome these difficulties by using a double set of brushes—the one fixed and the other removable—made by splitting up the single set into two equal parts. Lastly, numerous examples are given showing the uses to which these motors can be put.—London *Electrician,* Oct. 4, 1912.

Cascade Motor.—J. S. Heather.—A simple and elementary explanation of the principles of construction and operation of the Hunt cascade motor illustrated by diagrams.—London *Electrician,* Oct. 4, 1912.

Lamps and Lighting.

Safety Lamp.—F. Faerber.—A detailed illustrated description of the author's new electric safety lamp for mines. This lamp received the first prize in a recent British competition.—*Elek. Zeit.,* Oct. 3, 1912.

Vapor Lamp with White Light.—An English translation of the German paper recently abstracted in the *Digest* on the cadmium-mercury vapor lamp giving white light.—London *Elec. Review,* Oct. 4, 1912.

Generation, Transmission and Distribution.

Transmission of Heat.—C. H. Lander and J. E. Petavel.—A British Association paper giving an account of an experimental investigation of the transmission of heat from heated metal cylinders to the surrounding air, which has a direct bearing on the lagging of steam pipes. The results for bare steam pipes of different diameters are given in a table. The most interesting result is that from bare steam pipes the loss of heat is mainly due to convection. In the case of a pipe, for example, 1 in. in diameter, containing steam at atmospheric pressure, the loss by radiation is 15 per cent and by conduction 4 per cent, so that 81 per cent is dissipated by convection. At 100 lb. per square inch the loss by convection would be about 80 per cent. If the surface of the metal were machined the loss by radiation would be halved, and if it were polished the loss would be reduced to one-quarter. As all lagging materials are better heat

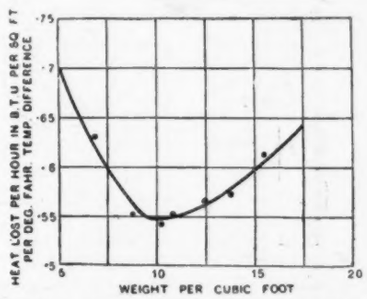


Fig. 1—Effect of Density of Covering on Heat Loss.

conductors than air, they increase the loss due to conduction. It is necessary, therefore, to arrange them loosely, so as to subdivide the air space surrounding the pipe as perfectly as possible with the least amount of solid material The lagging can, however, be too loosely packed, as will be seen in Fig. 1, which shows the effect of slag wool under various conditions as regards density of packing. The best result was obtained when the solid material occupied one-fourteenth of the total space. The conduction loss was then increased from 0.13 to 0.40, but (assuming radiation to be zero) the convection loss was reduced from 3.2 to 0.14, the total loss being one-seventh of that observed with the bare pipe.—London *Elec. Review,* Oct. 4, 1912.

Gas Engines.—The fifth report of the British Association committee on gaseous explosions (Sir W. H. Preece, chairman), giving a concise review of the present state of knowledge with regard to the heat flow from the working substance of a gas engine into the cylinder walls. The following factors of heat flow are discussed: The state of the walls, radiation from the gas, the effect of cylinder dimensions on heat flow, the effect of density, and turbulence.—London *Electrician,* Oct. 4, 1912.

Gas Engines.—A. E. L. Chorlton.—A British Iron and Steel Institute paper in which, after discussing the limitations which have prevented the progress of the large gas engine in England, the author describes a new type of engine (vertical duplex type) which is without many of the defects of previous designs and which is giving satisfactory results.—London *Electrician,* Oct. 4, 1912.

Load Factors.—S. A. Fletcher.—An article giving characteristic curves of typical loads of central stations and discussing the method of calculating the cost of generating energy on the basis of such load curves.—*Electric Journal,* September, 1912.

Traction.

Corrugation.—A preliminary report presented by a special committee of the British Municipal Tramways Association appointed to inquire into the phenomena of corrugation on tramway rails. The committee has come to the conclusion that corrugation occurs very widely with electrically propelled rolling stock, the construction of which necessitates a relatively low center of gravity; also on cable systems and to a small extent on steam railways. The guard-rail is not a necessary factor in corrugation, and the bulk of corrugation is not due to any action of the brakes, nor is its occurrence dependent on the number of cars passing over the rails. It is not necessary that the track, rolling stock or wheels should be in a worn condition. Corrugation appears independently of whether wheels are actively driven by the motors or not. It may be produced by one set of cars and removed by another, or caused and removed by the same set of cars under apparently the same conditions. The pitch of the corrugations is independent of the speed of the cars producing it. Corrugation does not exist on tramway rails as received from the rolling mills. It has been produced by every known type of electric car, and the pitch and characteristics are independent of the type of car. It is suggested that the brightness of the crests, as compared with the dullness of the hollows, is due to a purely rolling action under increased pressure over the crests. Although the committee considers that corrugation is due to causes external to the rail, it is of opinion that steel for rails can be obtained which is more durable and less liable to corrugation than ordinary varieties of steel at present in use. Rail steel with merely an increased carbon content is not sufficiently durable. It is necessary that the rail should be both hard and tough. The steel should be relatively high in manganese, carbon and silicon, and should be capable of passing certain tests.—London *Electrician,* Sept. 27, 1912.

Interpole Motors for Traction.—An abstract of the reports of Eisig and Bacqueyrisse to the International Street Railway Congress in Christiania. The latter's report, based on theoretical considerations, concludes from the answers received from forty-five tramway companies that

the interpole motor has proved its complete superiority. On the other hand, Eisig thinks that nothing new can be added at present to the old report of Lehrmann and that several points need further elucidation. The reports agree that the wear and tear of the commutator and of the carbon brushes and the formation of sparks, especially during braking, are less than with ordinary motors. Moreover, interpole motors can be operated at higher voltages and with a larger number of economical speeds. In most cases the use of interpole motors has resulted in a saving of energy of from 5 to 15 per cent, but this is true more for lines without grades than for those with grades. When braking with a weakened field the interpole motors are not excited quickly enough; nevertheless, Bacqueyrisse recommends using the electric brake as the service brake. The same reporter finds that the weight of interpole motors for the same rating is smaller and the first cost is only slightly higher than that of ordinary motors. Eisig, on the other hand, reaches the opposite conclusions. He also thinks the question is still open whether the interpole motor should have its normal rating when fully excited or with the field weakened. The former conditions may be preferable when the electric brake is used as the service brake, while the latter condition is more advisable on lines with small grades and long distances between stops.—*Elek. Zeit.*, Oct. 3, 1912.

Upper Silesia.—An illustrated article on energy supply to the network of trolley lines in upper Silesia. The total length of track is 115 km (69 miles). The trains follow generally at intervals of thirty minutes. The network was originally supplied with direct current at 600 volts from three power plants and one substation. This system was later changed to a three-wire system. Now three-phase energy is supplied in bulk at 6000 volts from the Upper Silesia electric works and delivered as 600-volt direct current in nine rotary-converter substations.—*Elek. Zeit.*, Oct. 3, 1912.

Installations, Systems and Appliances.

Automatic Motor Starters.—H. L. Beach.—An illustrated article on automatic motor starters and controllers for direct-current motors, for the case of loads having small inertia, such as centrifugal pumps and centrifugal fans.—*Electric Journal*, September, 1912.

Electrophysics and Magnetism.

Beta and Gamma Rays from Radioactive Substances.—E. Rutherford.—A paper on the origin of beta and gamma rays. The author outlines the following general views: The atom consists of a positively charged nucleus of very small dimensions, surrounded by a distribution of electrons in rapid motion, possibly of rings of electrons rotating in one plane. The instability of the atom which leads to its disintegration may be conveniently considered to be due to two causes, although these are not mutually independent; namely, the instability of the central nucleus and the instability of the electronic distribution. The former type of instability leads to the expulsion of an alpha particle, the latter to the appearance of beta and gamma rays. The instability which leads to the expulsion of a beta ray may be mainly confined to one of the rings of concentric electrons and leads to the escape of a beta particle from this ring with great velocity. The beta particle in escaping from the atom passes through the electronic distribution external to it, and in traversing each ring may lose part of its energy in exciting one or more gamma rays which have a definite energy which is characteristic for each ring. At present we have no definite information of the mode in which the transformation of a beta into a gamma ray or a gamma ray into a beta ray takes place, but it is no doubt connected with the structure of the ring of electrons, and possibly with its period of free vibration. The general evidence indicates strongly that the transformation of energy from the gamma-ray form to the beta-ray form or the reverse takes place in definite units which are characteristic for a given ring of electrons but vary from one to the other.—*Phil. Mag.*, October, 1912.

Photoelectric Action.—A mathematical paper by O. W. Richardson on a theory of photoelectric phenomena based on thermodynamic and statistical principles, and another paper by O. W. Richardson and K. T. Compton on the photoelectric effect. The authors show that there is a much greater unity in the relations between different metals and wave-lengths than has hitherto been supposed. It is shown that the important features of the photoelectric behavior of any metal are determined by a single parameter characteristic of the metal. The parameter has the dimensions of a frequency. The first part of the paper is a discussion of the experimental data. In the latter part of the paper the results are applied to test the theories of these effects which have been developed by Einstein and by Richardson.—*Phil. Mag.*, October, 1912.

Emission of Electrons by Metals Under Influence of Alpha Rays.—H. A. Bumstead and A. G. McGougan.—An account of an experimental investigation. Some of the results are as follows: The number of delta electrons emitted by a metal when struck by alpha rays varies with the speed of the alpha rays in the same manner as does the number of ions produced in a gas. Curves which represent this variation are similar in form to the Bragg ionization curve. Such curves have been determined for aluminum, copper, gold, lead and platinum. Within the limits of accuracy of the experiments they have the same form for all these metals. This agreement is in contrast with the fact that ionization curves for different gases and vapors show marked differences in form.—*Phil. Mag.*, October, 1912.

Detection of Combustible Gases in Air.—L. J. Steele.—A communication to the (British) Institution of Electrical Engineers on the Philip and Steele portable catalytic detector of combustible gases in air. The instrument gives an indication when inflammable gases are present in the air to as low a value as 0.025 of the amount necessary to render the mixture just combustible, though it is more usual to adjust the instrument to work at ten times this amount. In series with each of two similar platinum spirals C_1 and C_2 in Fig. 2, connected in parallel, is one coil of a differential relay $G_1 G_2$. The spirals $C_1 C_2$ are inclosed in glass tubes, through one of which a current of the air to be tested is passed by means of a small air pump when an observation is desired. The complete instrument consists of the detector described mounted on a tripod, the hand pump in one box and the relay with annunciators and indicating lamps in another. The annunciator coils are shown at $A_1 A_2$, and when the main switch is closed they indicate whether or

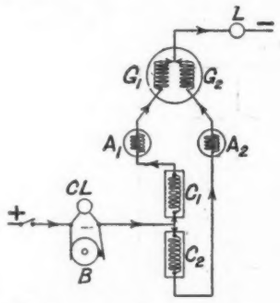


Fig. 2—Connections of Detector Circuits.

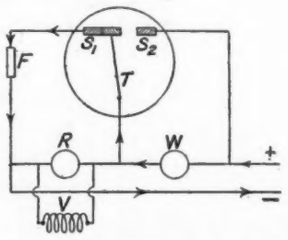


Fig. 3—Connections of Relay Circuits.

not the current is passing through C_1 and C_2, so that any breakage is immediately detected. The relay circuits are shown in Fig. 3, which is self-explanatory, R and W being red and white signal lamps, one or other of which is short-circuited by the relay according to the position of the tongue T, the bias of which is adjusted so as to obtain different sensibilities. In parallel with the red lamp R is a valve coil V (a single-stroke bell may also be included),

whose function is to cut off the supply of gas and to admit pure air to the platinum spiral instead of the test gases as soon as its temperature has risen sufficiently to cause the relay to act. The spiral then cools, the relay tongue swings back, re-establishing the circuit through the lamp *W* and short-circuiting the lamp *R*, when the cycle is repeated. A special feature is a rotary contact breaker *B* in the main circuit actuated by the pump handle. This contact breaker periodically short-circuits an incandescent carbon-filament lamp *CL*, of low resistance, which causes the pressure on the instrument momentarily to fall in value about once every two seconds. By this device hysteresis effects in the magnetized iron of the relay coils are minimized.—London *Elec. Eng'ing*, Oct. 3, 1912.

Changes in the Dielectric Constant Produced by Strain.—E. P. ADAMS AND C. W. HEAPS.—An account of an experimental investigation which shows that for solid dielectrics as well as for fluid dielectrics the change of the specific inductive capacity for unit strain along the lines of force and the change for unit strain perpendicular to the lines of force are practically equal.—*Phil. Mag.*, October, 1912.

De La Rive Tube.—D. N. MALLIK.—A mathematical paper giving the theory of electric discharge in a De La Rive tube.—*Phil. Mag.*, October, 1912.

Units, Measurements and Instruments.

Practical Standards for Electrical Measurements.—A report of a sub-committee of the British Association for the Advancement of Science (Lord Rayleigh being the chairman and R. T. Glazebrook the secretary of the committee). The report holds that so far as the absolute measurement of current is concerned an accuracy within at least five parts in 100,000 can be guaranteed. The Lorenz apparatus at the National Physical Laboratory and other apparatus now being constructed at Berlin and Washington will place measurements of resistance in a position equally satisfactory with those of current. The Lorenz apparatus is now being employed for the measurement of resistance, and it is believed that the probable error will not exceed two parts in 100,000. Measurements of resistance, of current and of emf are now made on the same basis in practically all civilized countries.—London *Electrician* and *Elec. Review*, Oct. 4, 1912.

Bridge Methods for Resistance Measurements of High Precision in Platinum Thermometry.—F. E. SMITH.—An account of an investigation carried out in the (British) National Physical Laboratory. The author describes in detail new methods for measuring the resistance of a platinum thermometer, all of which practically eliminate the effects of small changes in the relative resistance of the leads and have several advantages over methods hitherto used. The first of these four methods is as follows: The resistance scheme is that of a simple Wheatstone bridge, as

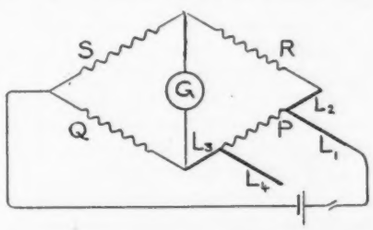


Fig. 4—Simple Wheatstone Bridge Arrangement.

will be seen from the connections shown in Fig. 4. *P* is the platinum thermometer with current leads L_1 and L_4 and potential leads L_2 and L_3. *Q* and *S* are the ratio arms and *R* is the adjustable resistance. There will be no current through the galvanometer when

$$P + L_3 = Q\,(R + L_2)/S \qquad (1)$$

When this balance has been made the potential lead L_2 is disconnected from *R* and joined to *Q*; L_3 is joined to *R* and the battery lead is disconnected from L_1 and joined to L_4. The new balancing condition is

$$P + L_3 = Q\,(R' + L_3)/S \qquad (2)$$

R' being the new value of *R*. From (1) and (2) we have

$$2P = Q\,(R + R')/S + (L_3 + L_2)\,(Q/S - 1) \qquad (3)$$

If $Q/S = 1$, then $P = (R + R')/2$.

However, it is not well to impose on a bridge the condition that the ratio coils shall be exactly equal. If we suppose Q/S is equal to $(1 + a)$ where *a* is small, a slightly different procedure must be adopted. At the same time as the leads L_1 and L_4 are reversed in position, the arms *P* and *R* are interchanged (Fig. 5). If this is done, we have as the first balancing condition (Fig. 4)

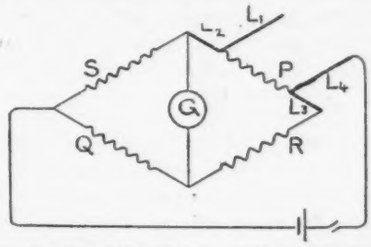


Fig. 5—Modified Wheatstone Bridge Arrangement.

$$P + L_3 = (1 + a)\,(R + L_2) \qquad (4)$$

and for the second (Fig. 6)

$$P + L_2 = (R' + L_3)/(1 + a) \qquad (5)$$

Combining (4) and (5), we have

$$P = \frac{R + R'}{2} - \frac{a}{2}\left\{ a\,(R + L_2) + (L_2 - L_3) \right\} \qquad (6)$$

If *Q* is equal to *S* within 2 parts in 10,000, then $a = 0.0002$ and *P* is equal to $(R + R')/2$ within 2 parts in 100,000,000. This is on the assumption that $L_2 = L_3$. If L_2 and L_3 each have a resistance of about 0.1 ohm but differ in resistance by 10 per cent, then the error introduced by neglecting *a* and taking the equation

$$P = (R + R')/2$$

as an exact one is equivalent to about 0.0001 deg. C. The want of equality of the leads and the want of equality of the ratio-coils may, therefore, be easily eliminated as sources of error. The reversals which have been indicated are conveniently made by means of a six-pole switch with connections as shown in Fig. 6. It is, of course, easy to arrange for the change in position of the battery lead to be made simultaneously. If the link *a* always forms a part of L_2, then *b* will always be in series with L_2 and *c* with *R*. Equality of the resistance of the links *a*, *b*, *c* is then of no importance. Mercury contacts are employed. A resistance capable of being changed in steps varying from 0.00001

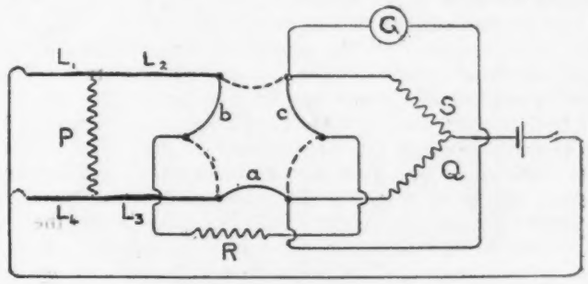


Fig. 6—Six-Pole Switch Arrangement.

ohm to several ohms is also described.—*Phil. Mag.*, October, 1912.

Electric Measurement of Wind Velocity.—J. T. MORRIS.—A British Association paper in which the author describes a method of measuring wind velocity in which an electrically heated wire is kept at a constant temperature when exposed to a current of air. The square of the power required to keep the temperature elevation constant is

nearly proportional to the velocity of the air current. Experiments carried out on this subject are described and some results are given. The author concludes that the constant-temperature bridge method of determining wind velocities is capable of considerable accuracy over a range well under 1 mile per hour up to at least 40 miles per hour. It has the advantage that it is not necessary for the observer to be constantly watching the relative position of a meniscus of water and a "hair-line" in a telescope, as in the Pitot tube method, for the eye can be utilized to assist in making other observations while glancing at intervals at large-sized movements on a switchboard instrument.—London *Electrician*, Oct. 4, 1912.

Water-Cooled Brake Drum.—H. H. Broughton.—An illustrated article in which a new form of anti-splash brake drum is described, and it is suggested that the arrangement might be useful in cases where overheating is liable to occur owing to the severity of the service.—London *Electrician*, Oct. 4, 1912.

Telegraphy, Telephony and Signals.

Loaded Telephone Lines in Europe.—In continental Europe there are now more than 10,000 km (6000 miles) of telephone lines loaded with Pupin coils. The longest overhead loaded lines are from Berlin to Aix-la-Chapelle (700 kw, or 420 miles) and from Berlin to Frankfort (580 km, or 350 miles). Still longer will be the line from Berlin in Germany to Milan in Italy now under construction (1400 km, or 840 miles), which is to be extended later to the city of Rome (total length 2000 km, or 1200 miles). This, however, is still below the longest American loaded line, from New York to Denver (1900 miles). There are also a number of underground cables and the following submarine cables loaded with Pupin coils: From Freidrichshafen to Romanshorn (12 km, or 7 miles); from Dover to Calais (40 km, or 24 miles); from St. Margaret's Bay in England to La Panne in Belgium (88 km, or 53 miles).—*Elek. Zeit.*, Oct. 3, 1912.

Submarine Telegraph Relays.—A note on a recent British patent (No. 19,779, Sept. 26, 1912) of S. G. Brown. Two thermo-electric couples (usually of platinum and platinum-rhodium) are mounted on the end of a light, rigid, swinging arm, controlled by the currents in the cable circuit. The couples may be heated by two small burners with fine vertical and transverse adjustments and normally lie symmetrically just outside and between them, so that they are both at the same temperature. A small movement of the couple plunges one junction into the outer portion of its flame, so that a large temperature difference is produced. The recorder coil is preferably of low resistance.—London *Elec. Eng'ing*, Oct. 3, 1912.

Spark-Gaps in Running Liquids.—W. H. Eccles and A. J. Makower.—A British Association paper in which experiments are described in which spark-gaps immersed in running liquid were used for the production of electrical oscillations. The voltage required is lower than in air. The efficiency depends on the rate of flow of the liquid and on the voltage applied, but not greatly on the length of the gap. Water may be used for the purpose, but it has been found that oil has better quenching properties.—London *Electrician*, Sept. 13, 1912.

Miscellaneous.

South America.—L. W. Schmidt.—The conclusion of his statistical article on the development of the market for electric products in South America. The United States, England and Germany are the chief exporters of electric products to South America, and the United States shows the largest increase in percentage of the exports.—*Elek. Zeit.*, Oct. 3, 1912.

Training of Electrical Engineers.—W. Reichel.—A continuation of his long German paper. The author gives an outline of suitable courses during the first three years. The paper is to be concluded in a subsequent issue.—*Elek. Zeit.*, Oct. 3, 1912.

French Association for the Advancement of Science.—A note on the recent convention of the French Association for the Advancement of Science held at Nimes under the presidency of Lallemond. Among the papers presented and partly given in this issue is one by Féry on his new bomb calorimeter, one by Leduc on the cycle of the steam engine, three papers by Turpain on vertical and horizontal antennas for wireless telegraphy, on the possibility of recording telegrams received by wireless telegraph and on a new micro-ammeter for the recording of electric waves; a paper by Salomon on chemical reactions in the electric arc, and a paper by Turpain on light pressure.—*La Revue Elec.*, Sept. 13, 1912.

Book Reviews

Human Factor in Works Management. By James Hartness. New York: McGraw-Hill Book Company. 159 pages. Price, $1.50.

A short treatise on the human element in industrial efficiency. The author lays special emphasis on the proper use of the mind and the value of correctly formed habits. Of the six chapters which make up this volume, so full of human interest, the first four comprise Part I, which is devoted to the value of habit. Our much-talked-of business systems, the author points out, are a means instead of an end, and success depends more on the man than the plan. Part II comprises some non-technical phases of machine design bearing on the natural fitness of the individual for his work and the relation of physical condition to efficiency. Part III is devoted to machine building for profit, dealing with such topics as the effect of environment, trivial details, specialization, ambition mania and business confidence. This interesting volume, while not going deeply into its subject at any point, is written in a breezy, refreshing style which is certain to benefit the industrial manager or employee who has unconsciously fallen into a rut or "gone stale" at his work.

Costruzioni Elettromeccaniche. By E. Morelli. Torino: Unione Tip.-Editrice Torinese. Vol. I, pages 481 to 640. Price, 4 lire.

This is Section 4 of Volume I of an excellent textbook on direct-current dynamo-electric construction and design. The book is being issued in sections of 160 pages each, which brings regularity and uniformity into the printing, publishing and distributing offices, but leaves the text in a discontinuous and heterogeneous arrangement among the sections. This section includes part of Chapter III—on the electrical elements of a dynamo armature; all of Chapter IV—on the magnetic elements of a dynamo armature; all of Chapter V—on the electrical elements of a dynamo field magnet, and a portion of Chapter VI—on the mechanical elements of a dynamo field magnet.

The book is well and amply illustrated, especially on the mechanical side of the subjects treated. The design and construction of direct-current machines are discussed from the standpoint of the engineer for presentation to electrical-engineering students.

One of the first questions discussed in this section is the mechanical balancing of dynamo armatures to minimize their vibration at full-speed rotation. The theory of the subject is only outlined, but the practical procedure recommended is excellent.

The treatise will be of interest to all students of direct-current dynamo machinery in general, and particularly to those who can read Italian and are interested in Italian construction.

New Apparatus and Appliances

EDISON ALTERNATING-CURRENT RECTIFIER.

An electro-mechanical rectifier has recently been developed by Thomas A. Edison, Inc., and placed on the market by the Edison Storage Battery Company of Orange, N. J., the apparatus being specially adapted to the charging of sparking batteries from an ordinary 110-volt alternating-current circuit. The rectifier has no revolving armature, commutator, or any wearing part requiring lubrication, and it uses no vacuum tube or high-tension discharge method. The apparatus is arranged so that the circuit to the battery is closed on the positive wave and opened on the negative wave by the vibratory action of several armatures. Current is brought to the rectifier at from 12 volts to 14 volts, and the equipment is designed to give a maximum output of 8 amp in the "B2" size and 16 amp in the "B4" size. Variations in the current values are obtained by the use of a controlling resistance connected with the rectifier.

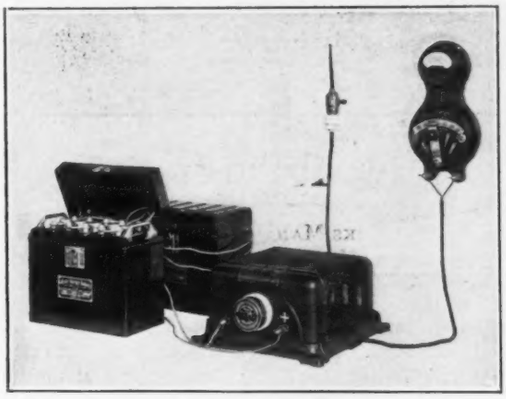


Fig. 1—Rectifier Charging Storage Battery.

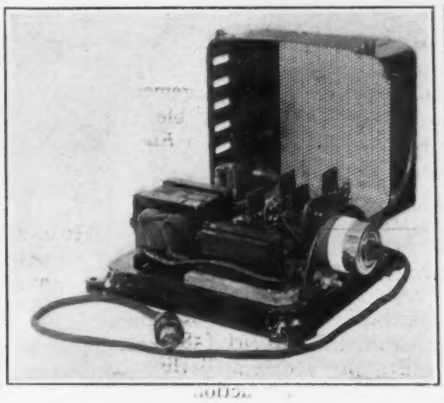


Fig. 2—Interior of Rectifier.

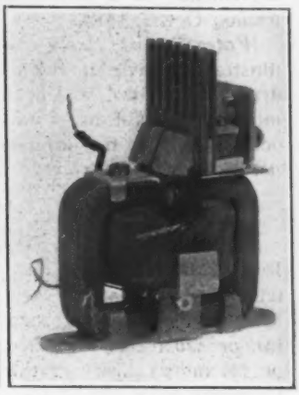


Fig. 3—Rectifier Unit.

In operation the line current is brought to a small transformer which cuts down the voltage as stated. The circuit carrying the rectified current goes through the secondary winding of the transformer, through the vibrating contacts into the battery and back to the transformer. The vibrating armatures are kept in motion by the surrounding magnet coils, connected in series, and the moving parts are operated in synchronism, the movement being timed to compensate for the lag in the rectified circuit by a condenser in the coil circuit. An automatic switch opens the circuit to the battery when the line voltage fails and closes it when the pressure is re-established. The wiring is exceedingly simple, consisting of the usual connecting cord and plug and a charging lead running from the positive side of the charging terminals on the rectifier to the positive pole of the battery and another lead connecting the negative terminals. All rectifiers are provided with terminals for connecting a rheostat into the charging circuit, the instruments being furnished separately or combined on one panel as desired.

The rectifier is placed in operation by connecting the flexible cord with the attachment plug to the source of supply, the battery terminals being properly connected to those of the rectifier. Turning a double-pole snap switch on the front of the rectifier completes both the line and battery circuits. With the use of the controlling rheostats the current can be reduced to that necessary to charge the smallest storage cells on the market. The energy consumption of the "B2" rectifier is 160 watts and of the "B4" 300 watts. The efficiency ranges from 48 to 53 per cent, and the length of time necessary to charge batteries from the rectifier is the same as when charging from an ordinary direct-current circuit. It is said that these rectifiers have been operated at continuous load for over 3000 hours without stop for cleaning or adjustment and at the end of the run were found in perfect condition. This is equal to several years' duty in ordinary charging service. The manufacturer states that so far no renewal of parts subject to wear has been found necessary, but when repairs are needed the expense of renewals is slight and no special skill is required to readjust the apparatus. A complete line in sizes up to 100-amp capacity is under construction.

GASOLINE-ELECTRIC GENERATING SET.

The gasoline-electric generating set has proved to be an economical and reliable source of energy supply for consumers not located within the distribution network of a central station. The sets illustrated herewith are manufactured by the B. F. Sturtevant Company, Hyde Park, Boston, Mass., and it is claimed that these sets have given perfect satisfaction in operation under the most trying conditions. At present sets of 5 kw, 10 kw and 15 kw are being built. These sets consist of a 4-cycle, vertical, water-cooled gasoline engine with four or six cylinders, according to size.

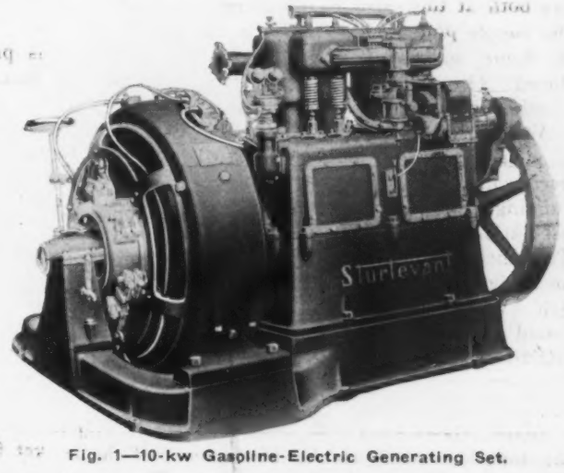


Fig. 1—10-kw Gasoline-Electric Generating Set.

The cylinder of the 5-kw set is cast in one piece with L-shaped heads, and the larger sizes are cast in pairs with T-shaped heads. All sizes have integral water jackets.

Bearings and bushings are of Parsons white brass, connecting rods of dropped forged steel and crank shaft of nickel steel. The cam shafts with integral cams are gear-driven from the main shaft. The 5-kw set has one cam shaft, while the other sizes have two each. The base is a casting of iron in two sections split on the center line of the engine. The lower part of the base contains the

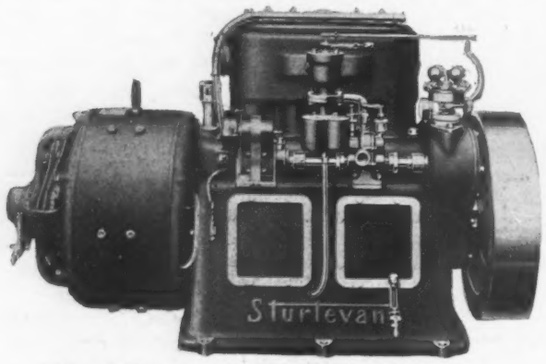


Fig. 2—5-kw Gasoline-Electric Generating Set.

lubricating oil. A separate sub-base holding both engine and generator is furnished with the two larger sizes, while with the smallest set the generator is overhung on the engine base.

The sets are throttle-controlled by means of a governor of the centrifugal, vertical type. It is claimed that there is noticeable fluctuation in voltage from no-load to full-load or from sudden variations of load.

The lubrication is positive and forced, oil being supplied by a pump to all the bearings. A filter in connection with the pump insures a supply of clean oil. Arrangement is made for cleaning this filter without drawing off the oil. A pump which circulates cooling water through the jackets is gear-driven from the crank shaft. Ignition is furnished by a Bosch high-tension magneto driven by gears from the crank shaft. No battery is necessary for starting. A Sturtevant constant-level carburetor is used in connection with a plunger fuel pump.

The generator is of the Sturtevant direct-current type. Both engine and generator are capable of maintaining an overload of 25 per cent for two hours.

ELECTRIC RANGE FOR THOMPSON'S SPA, BOSTON.

The successful use of many small electric heating devices at Thompson's Spa, Boston, Mass., during the past few years has resulted in the purchase by the management of

ELECTRIC RANGE, THOMPSON'S SPA, BOSTON.

Equipment.	High Heat, Watts.	Lowest Heat, Watts.
Two ovens, total	4,800	1,600
Toaster	1,700	550
8-in. disk stoves, five, total	3,675	1,250
6-in. disk stoves, four, total	1,760	600

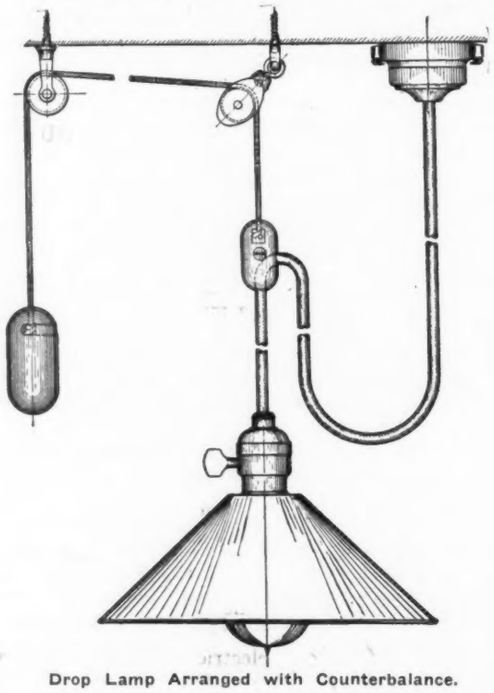
that noted luncheon establishment of a special electric range illustrated herewith. The range is the largest electric equipment of its kind in use in Boston and is 9 ft. long, 3 ft. wide and about 2.5 ft. high at the front, the rear height being about 5 ft. to enable two shelves to be utilized at the top of the outfit. The range is operated as a day load on Boston Edison service and consists of two ovens, 19.5 in. by 27 in. by 13.5 in. in dimensions and one 10-in. by 12-in. toaster, one 8-in. deep fat fryer for doughnuts or French fried potato service and four 6-in. and five 8-in. disk stoves. Each oven can cook sixteen chickens or 64 lb. of beef and could have been made larger if necessary in the frame used. The frame is of Russia iron with polished steel trimmings, and each heating element is provided with an

Electric Range for Thompson's Spa, Boston.

independent four-point switch controlling high, medium and low heats in each case. Since the installation of the range the switches have been mounted on a slate panel at the top of the frame, fuses and terminal blocks being located in a cut-out cabinet in the middle of the lower section. The heating devices are connected on a balanced direct-current three-wire circuit, the range of wattage on maximum and minimum being as shown in the accompanying table.

COUNTERBALANCE FOR DROP LAMPS.

The simple and inexpensive device for vertically adjusting incandescent drop lamps shown herewith and manu-



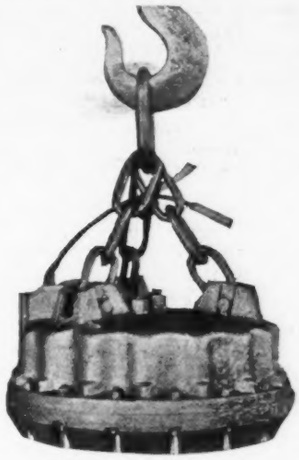
Drop Lamp Arranged with Counterbalance.

factured by the Sachs Laboratories, Inc., Hartford, Conn., operates on the counterbalance principle, without springs, latches or similar contrivances. It consists of a two-part insulating clamp attached at a suitable distance from the socket to the flexible drop and to a suspending cord passing

upward over a swivel to a fixed pulley on the ceiling and a counterbalance weight. The lamp hangs suspended from the clamp as it would from any rosette, without entangling and undesirable cords. The device is furnished with a counterbalance weight adapted to the ordinary socket, lamp and shade, although larger or smaller weights are obtainable. The clamping channel is proportioned to grip "New Code" reinforced flexible cord.

LIFTING MAGNETS.

A 24-in. circular-type lifting magnet has been added to its line of standard sizes by the Cutler-Hammer Clutch Company, Milwaukee. It is a development of a type



24-in. Lifting Magnet.

recently made for submarine service and previously described in these columns. The magnet illustrated herewith was provided with a special pole shoe for handling 24-in. and 36-in. skull-cracker balls. The net weight of this magnet is 750 lb. and it can lift ten times its own weight.

MOLDED INSULATING COMPOUNDS.

By R. B. Lattin.

The efficiency of the insulating parts of all electrical apparatus is so important a matter that great care should be exercised by every manufacturer to obtain the insulating material best suited to his special purpose.

That the best insulating material for one purpose is not necessarily the best for all purposes is illustrated, for instance, by glass, a high grade of which is an excellent insulator, so far as its dielectric strength is concerned, but is entirely too fragile for use in connection with electrical machinery.

Many insulating compounds have been invented in an effort to combine as far as possible all of the elements necessary in an insulating material suitable for general use in the electrical field, but these have failed to give satisfaction. In other insulating compounds some property has been developed to a high degree, but this is nearly always done at the sacrifice of other properties. For instance, compounds that possess a high resistance to heat are usually weak electrically and are seldom capable of withstanding moisture without absorption.

The uses for molded insulation are so many and differ so widely in their requirements that special materials have to be developed to meet the different classes of work. These special materials are molded together into insulating compounds that sacrifice nothing in the way of insulating strength for the purposes for which they are designed.

Below there is given a brief description of the various molded insulating compounds for electrical work as manufactured by the Johns-Pratt Company, Hartford, Conn., for which the H. W. Johns-Manville Company, New York, is the selling agent.

"Fine black mica" is a shellac compound possessing high dielectric strength, together with good mechanical strength. It is composed of finely divided filling material and has for a binding material the best shellac obtainable, which makes it non-hygroscopic and, therefore, weatherproof. Owing to the finely divided material used and the fact that it flows easily in the mold, it readily lends itself for use in making complicated molded pieces that are to be used on electrical appliances where the piece must have a good appearance and also be exposed to weather conditions. Although this material softens at quite a low temperature, yet it withstands a sufficient amount of heat to make it serviceable on all classes of electrical machinery that are subject to temperatures common in factories and other places where proper ventilation is secured.

"Xite" is a molded compound used quite extensively in the manufacture of overhead-line material. This compound possesses good dielectric and mechanical strength, but does not take a high finish. Like all the shellac compounds, it is not to be included among the heat-resisting materials, it being serviceable only in places where normal atmospheric temperatures prevail.

"Molded mica" is another compound used principally in the manufacture of over-line material. It excels "'xite" in durability, dielectric strength, mechanical strength and heat resistance. The weatherproof qualities of this compound are of the best and it has a better appearance than "xite," thus making it a suitable material for special insulating pieces where the heat requirements do not exceed 150 deg. Fahr.

"Brown mica" has been manufactured for the past twenty-five years, and is the material best adapted for special insulated pieces where great mechanical strength and toughness are of prime importance. It takes a good finish and withstands temperatures up to 150 deg. Fahr. The nature of the material makes it possible to mold it very accurately into intricate pieces. It flows readily in the mold, thus reducing the tendency to unduly strain the mold, as is the

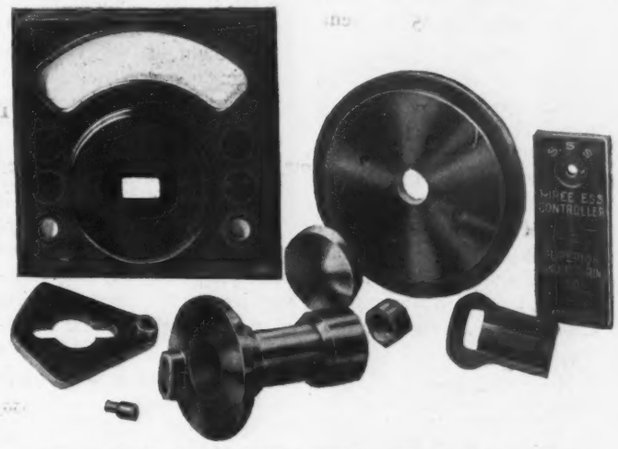


Fig. 1—Parts for Electrical Devices Made of Insulating Compounds.

case with some of the more fibrous high-heat-resisting compounds.

"Gray monarch" is a compound which has been employed extensively for molded insulating pieces to be used in connection with commercial machinery where the temperature rises somewhat above the normal atmospheric average. It is a very fibrous compound and consequently possesses a high mechanical strength, but it does not take a high finish. It is recommended for use only in making up pieces where

appearance is not of prime importance. It is quite hygroscopic, making it unfit for use in very damp places or exposed to the weather. This compound does not possess a high dielectric strength and cannot withstand voltages above the normal tension in trolley and lighting circuits.

"Vulcabeston No. 30" possesses a fair dielectric and mechanical strength, but is somewhat hygroscopic owing

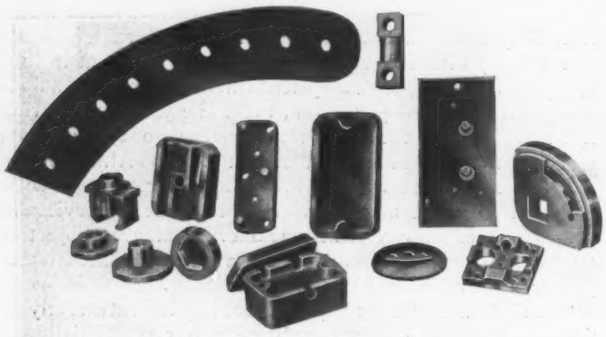


Fig. 2—Parts for Electrical Devices Made of Insulating Compounds.

to its very fibrous nature. Its main characteristic is its ability to withstand temperatures up to 400 deg. Fahr. It is used only for insulating pieces and is especially well adapted for making boxes and linings for arc deflectors. Owing to its dull gray appearance it is unsuitable for places where a high finish is of importance, but it is well adapted for insulating bushings, etc., used in connection with motors and generators, provided it does not come in contact with an excessive amount of oil and is not exposed to dampness or the weather.

One form of "vulcabeston" which is used quite extensively is made up in sheets of various thicknesses. The stock from which it is made differs from the regular material in that it has much longer asbestos fibers, thus giving it greater mechanical strength and more elasticity but slightly decreasing its dielectric strength. This class of material is serviceable in places where a few thin insulating pieces are desired and the quantity is insufficient to make it practicable to manufacture molds.

"Vulcabeston No. 201" is the latest development in this class of materials. Its composition does not materially differ from the regular grades, but owing to special treatment it produces a finished insulating material which possesses greater dielectric strength and also greater mechanical strength than No. 30. It withstands temperatures up to 600 deg. Fahr. without disintegrating. One of its most valuable characteristics is its non-absorptive qualities. Oil has no effect upon this material and therefore it is suitable for bushings, etc., on commercial machinery where there is an excessive amount of oil. It is well adapted for making up insulating handles and plugs for cooking utensils and other devices which require a good heat-resisting compound. Although quite strong, it is inelastic and therefore cannot be used in places where it has to change its shape when subjected to pressure nor where a drive fit is necessary in assembling it into a machine.

"J-P bakelite" is especially adapted for the molding of complicated insulated pieces where a high mechanical and dielectric strength is required in connection with good heat-resisting qualities and good appearance. It is very strong, resists heat up to 400 deg. Fahr., has dielectric strength to withstand 250 volts per mil and is also non-absorptive and unaffected by acids or alkalies. When formed in a highly polished mold the pieces present a very fine appearance, and it is applicable to the making of insulating pieces in place of hard rubber. The high finish does not deteriorate with age, being absolutely permanent under ordinary atmospheric conditions.

All the above materials except "vulcabeston No. 30" are well adapted for making insulated pieces into which metal inserts are to be molded. There are many instances where a manufacturer of electrical machinery assembles metal parts into the molded blocks when he could without added cost obtain these pieces with the metal parts molded in, thus saving the expense of assembling. In general, it is just as cheap to mold the insert in place as it is to mold a hole into which to assemble it.

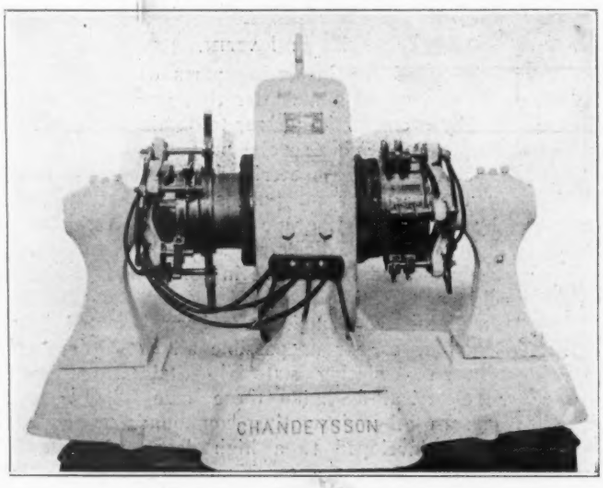
In the majority of cases it is quite impracticable to machine molded insulation, because most compounds contain a mineral filler which rapidly takes the edge from a tool, thus preventing it from making a true surface. It is much more satisfactory to mold the piece into the desired shape than to attempt machining it.

APPLICATION OF SMALL ROTARY CONVERTERS.

A line of rotary converters ranging from 1 kw to 100 kw has been developed by the Pan Electric Manufacturing Company, 731 South Fourth Street, St. Louis, Mo. A number of installations have been made of various sizes. The sets are recommended for use in garages, printing establishments, and in general where it is desired to transform two-phase or three-phase alternating current to direct current. With some modification in the field construction, they can also be used as inverted converters.

One installation of the latter kind was a 20-kw inverted converter for supplying energy for a sign containing 8000 2.5-watt incandescent lamps. The load on this machine was later on raised to nearly 12,000 lamps, which was carried satisfactorily. In another instance a 5-kw, two-phase rotary converter was installed to operate an electric sign in conjunction with tungsten lamps in place of carbon lamps, which arrangement reduced the consumer's monthly bill from an average of $130 to an average of $44, while giving improved illumination. This installation helped in securing other contracts for the sign company and central station, so that the central station's loss in business was made up several times by new customers.

In one case three-phase current was available and 110-volt direct current was desired for electrolytic purposes. A 20-kw, 900-r.p.m. rotary converter for twenty-four-hour service was installed after a series of tests had demon-



Small Rotary Converter.

strated to the purchaser's satisfaction that the over-all efficiency of the machine and the transformers was more than 90 per cent. One hundred per cent overload was maintained for four hours with a rise in temperature of 38 deg. C. on the commutator. It is stated that a number of other installations with equally good results have been made.

HOLLOW REINFORCED-CONCRETE POLES.

The accompanying illustrations show parts of hollow reinforced-concrete poles manufactured by the R. M. Jones process. The pole is shaped by rolling it in a belt, no exterior forms being employed. The rolling process in compression is said to cause better tamping effects than can be accomplished in any other manner. The mixture is made quite dry, but the compression is such as to bring the water to the surface. The mandrel, which is covered with sheet steel, made in two parts, remains in the pole until the concrete sets, when the mandrel and the sheet-steel covering which form the core are removed. The ratio of taper adopted is 1 in. diameter for each 6 ft. in length. The concrete wall is 1.5 in. thick, and its application to a 36-ft. pole results in a product with an outside diameter of 12 in. and an inside diameter of 9 in. at the butt and an outside diameter of 6 in. and an inside diameter of 3 in. at the top. The reinforcement, which is centrally located in the concrete wall, is composed of five sizes of square-twist steel reinforced bars, ranging from 0.25 in. to 0.5 in., woven with steel wire warp at 6-in. intervals. The reinforcement consists of ten bars of any selected size the entire length, eighteen bars two-thirds of the length and twenty-six bars one-third the length of the poles. This is woven on a tapered mandrel in a specially prepared loom, which is afterward placed upon the mandrel, and the warp which forms the circumferential reinforcement is united by twisting one around the other. The warp may be varied in size from No. 6 to No. 10 steel wire, as required for producing desired strengths. The woven reinforcement is held centrally between the inner core and the outer circle by pole step sockets woven between two bars of the reinforcement. Distance pieces are also provided for centralizing the reinforcement at other positions around the pole. The process of forming poles by rolling them in a belt and passing them between compressor rolls is claimed to produce stronger, straighter, smoother and less expensive poles than any other process. The system as a whole is marketed by R. M. Jones & Company, Denver, Col.

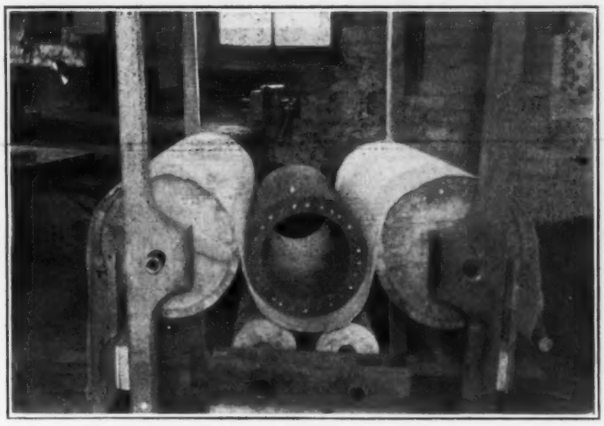


Fig. 1—Experimental Machine of Compression-Roll Type.

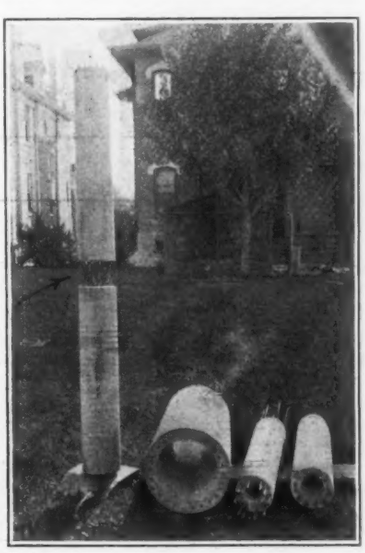


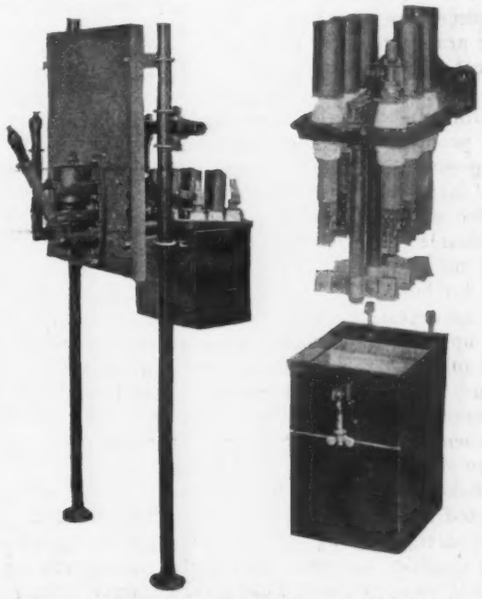
Fig. 2—A Joint Complete Except for Filling with Concrete.

Fig. 3—Hollow Reinforced Concrete Poles.

OIL SWITCH FOR SWITCHBOARD MOUNTING.

The accompanying illustrations show the smallest oil switch manufactured by the General Electric Company for switchboard mounting. It was developed particularly for use in isolated and small plants and will provide adequate protection on alternating-current circuits up to 200 amp and 3300 volts.

The entire mechanism and oil tank, except the operating handle on the front of the board, are suspended from a single frame. The oil vessel is of heavy sheet metal lined with an insulating material and provided with barriers between poles. The contacts provide two breakers in each phase and open by gravity. This switch is made in double-pole, triple-pole and four-pole type, both non-automatic and automatic for hand operation.



Small Oil Switch Mounted on Switchboard.

Industrial and Financial News

THE impetus that was given to commercial and industrial operations when the movement of the crops began to assume large proportions has resulted in imparting a high degree of business activity all over the country. Each week is showing improvement in the situation. Transportation facilities are experiencing a very heavy demand, the leading industries are expanding rapidly, and the demand for early delivery of materials is very pronounced. Shortage of labor and of railroad equipment is restricting delivery in many instances. Bank clearings last week showed an increase of three-tenths of 1 per cent over those of the week preceding and of 4.2 per cent over those in the corresponding week of 1911. Money is in active demand and rates continue firm. Collections are improving and business failures are smaller in number than they have been in recent weeks or in the corresponding weeks in the past few years. Substantial gains are shown in the earnings of many of the electrical manufacturing and public-utility companies. A good demand exists for electric-heating appliances and for wire, and both of these branches of the industry show much expansion as compared with last year's business.

Water-Power Developments of H. M. Byllesby & Company.—In a general paper on the subject of "Water-Power Development and Its Relation to Public Utilities," read before the American Electric Railway Association in Chicago on Oct. 8, James E. Hewes gave some interesting specific information in relation to the hydroelectric developments of H. M. Byllesby & Company in operation or about to be made. In the watershed of the Mississippi ten or twelve water-power developments are owned and operated by this company. These are located in or near Minneapolis and St. Paul, at Cannon Falls and Mankato, Minn.; also on Apple River, Wis. Mr. Hewes said in part: "On the New River in West Virginia we have developed two water-powers, and there are two other water-powers which will be developed in the near future. This installation on the New River is unique in that almost one-half of the entire market for the power developed is to supply electrical energy to coal mines. Now we have often been led to believe that the further away a water-power development was from cheap coal the more profitable it would be, but I can assure you that while these developments on the New River have just been put in operation, and we cannot tell you from the actual operation of the plants what the profit will be, yet the signed contracts for service in the Pocahontas coal field will show a return on the investment greater than my company dared to predict in its prospectus. We are about to develop a large installation on the Caney Fork River in the near future to supply Nashville, Chattanooga and Knoxville, Tenn., with energy. In conjunction with E. W. Clark & Company, we have developed on the Ocoee River, in Tennessee, 20,000 hp and are now building an additional development of 15,000 hp. We are building a 150-mile, 125,000-volt transmission line between Chattanooga and Nashville for the distribution of this energy to these two cities, and we have just completed a transmission line into Knoxville, Tenn., and Rome, Ga. By the time this project has reached its full development stage we shall be able to supply electrical energy to every town and city in three-fourths of the State of Tennessee. The effect of this development alone upon the community has been to cause an enormous interest in the natural resources of the country, and it is already causing large manufacturing industries, dependent upon a large supply of energy and cheap labor, to open negotiations for the purchase of such energy." Details of this project of the Tennessee Railway, Power & Light Company appeared in these columns April 13, 1912.

Manhattan Electrical Supply Company's New Stock.—As was noted in these columns last week, the stockholders of the Manhattan Electrical Supply Company, 17 Park Place, New York, have authorized an increase in capitalization from $750,000 to $5,000,000, the directors have authorized a 100 per cent stock dividend on the common stock and plans have been made for selling an allotment of the new stock at par to employees. Further details now available show that the present $150,000 preferred stock will be increased to $500,000 and that the common stock will be made $4,500,000 instead of $600,000. The profit-sharing plan through which employees may purchase stock in the company provides for offering to them as par an amount of stock equal to 25 per cent of their yearly salaries and allowing them five years in which to pay for it. Present stockholders will have the opportunity to subscribe for the new stock at par to the amount of their present holdings. It is planned to bring in about $500,000 additional working capital at this time to be used for extension purposes. All of this not subscribed for by employees or by present stockholders will be offered to the public. Of the $5,000,000 comprising the total authorized issue $1,850,000 is to become outstanding at this time. This will be made up of $1,200,000 common, $150,000 preferred and $500,000 of either preferred or common. The company has only twenty-two stockholders. Its new manufacturing plants, which are situated at Jersey City, N. J., and Ravenna, Ohio, are rapidly approaching completion.

Sanitary District Awards.—Recent contracts for electrical material have been awarded by the board of trustees of the Sanitary District of Chicago as follows: Single-conductor armored cable, Standard Underground Cable Company, 20.4 cents a foot; series inclosed alternating-current arc lamps, General Electric Company, $27.50 each (less $3 for each old arc lamp taken in exchange); single-conductor lead-covered cable, Standard Underground Cable Company, 12.1 cents a foot; auto transformers, Delta Star Electric Company, $620 each. The auto transformers mentioned will be used to reduce the voltage of a 12,000-volt circuit to supply 11,000-volt, three-phase, 60-cycle, 1200-hp synchronous motors which at times will be over-excited and act as rotary condensers. These motors will be used in connection with the execution of the Sanitary District's street-lighting contract with the city of Chicago. Not less than three nor more than six will be required. Orders have been placed recently with the Chicago Insulated Wire & Manufacturing Company for 50 miles of No. 6 weather-proof copper wire, delivered at 17.85 cents a pound and also with the John A. Roebling's Sons Company for 50 miles of No. 6 weather-proof copper wire for 17.86 cents a pound.

Dayton (Ohio) Power & Light Company Enlarges Its Holdings.—Frank M. Tait, president and general manager of the Dayton (Ohio) Power & Light Company, acting for that company, has taken over the Miami Light, Heat & Power Company of Piqua, Ohio, a city of over 14,000 inhabitants, about 25 miles northwest of Dayton. The purchasers will extend a pole line from Dayton to Piqua and inaugurate a vigorous new-business campaign in Piqua as soon as application for approval of the purchase has been made to the Ohio Public Service Commission, and the latter has given this approval. The Miami company has $300,000 stock outstanding and $167,500 of bonds. In addition to its commercial business, it has a city lighting contract and also furnishes steam heating. The gross earnings of the Dayton company for the nine months ended Sept. 30 were $488,362, which compares with $446,000 in the corresponding period of 1911. Net income, after all deductions, was $107,413, as compared with $63,089 in the nine months ended Sept. 30, 1911.

General Electric's Business Expanding.—During the nine and one-half months since Jan. 1 gross sales of the General Electric Company have been at a rate closely approaching $83,000,000 per annum, which compares with $69,851,275 in the twelve months ended Dec. 31, 1911. This represents an increase in gross of more than $13,000,000 per annum, or 18 per cent. The business of the past two months has shown a decided increase. With continuance of the gains made, it is possible that the year's business will reach $95,000,000. Whether or not higher prices will result if the present volume of new business continues remains to be seen.

Proposed Unification of Street-Railway Systems in Chicago.—The matter of combining the surface street-railway interests in Chicago was discussed at a meeting of the local transportation committee of the City Council on Oct. 17. Leonard A. Busby, president of the Chicago City Railway Company; Williston Fish and W. W. Gurley, respectively first vice-president and general counsel of the Chicago Railways Company, were present. The street-railway men said that they did not see any insuperable objection to unification of all the surface street-railway interests in Chicago. It might be advisable to retain separate corporations, united, however, under an operating agreement whereby all receipts and expenditures would be common funds, the net receipts to be apportioned to each company by some agreement. For purposes of operation this plan would enable the various lines to be considered as one property. A complete consolidation of the companies might follow this plan, but it would take some time to effect it, whereas unified operation could be put into effect without great delay. As to the general merger of all the elevated and surface railways, which has been proposed, Mr. Busby explained that that would require a statutory enactment, as the elevated-railway companies are incorporated under the railway law, while the surface street-railway companies are incorporated under the general corporations act. However, the necessary legislation might be procured in time. Mr. Gurley explained in addition that the fact that, though there was a valuation of the surface properties, the city and the elevated companies had not been able to reach an agreement as to valuation, added a serious complication to the prospect of a general merger of all the transportation companies at the present time. A sub-committee of five aldermen was appointed to consider the subject of unification of street-railway interests.

General Vehicle Head Deplores Lack of Capable Salesmen.—President P. D. Wagoner, of the General Vehicle Company, in discussing the motor-truck situation and commenting upon the changes in the staff of his company, to which reference was made in the *Electrical World* last week, said recently: "The industry is just beginning to appreciate the dearth of capable motor-truck salesmen—men who can produce business under a policy which insures satisfaction to the buyer and justice to the trucks. At first glance one might think that the marketing of electric trucks was a harder problem than selling gas trucks, but experience indicates there is little difference in selling either kind when they are sold right. In other words, certain standards of salesmanship must be maintained if we would secure reorder business, as that, with a constant supply of new customers, is what builds up confidence in a product. I think until recently too much thought has been given to getting distribution quickly, oftentimes at the expense of things more essential. We all have our problems, but with experience comes the knowledge to surmount them."

Pacific Light & Power Buys Equipment.—The Westinghouse Electric & Manufacturing Company has received an order from the Pacific Light & Power Company, of Los Angeles, Cal., for electrical apparatus totaling $350,000 in value. The order includes two 17,500-kw, 6600-volt, three-phase waterwheel-type generators; one 200-kw motor-generator set, one 6600-kw, 6600-volt synchronous condenser, together with a quantity of auxiliary apparatus. The apparatus is for use in a water-power plant near Fresno, Cal., and the energy generated will be transmitted at the potential of 150,000 volts to two substations located 135 miles and 275 miles respectively from the plant. The energy is to be used in and around Los Angeles. The Pacific Gas & Electric Company, also of California, has placed an order with the Westinghouse company for four waterwheel-type generators of large voltage to be used in the San Francisco district.

Work on Cheat River Dam Delayed.—Through a decision that has just been handed down by Judge J. W. Mason of the Circuit Court of Monongalia County, W. Va., in which it is held that the Cheat River between the Pennsylvania and West Virginia State boundaries and at several places up the river is a navigable stream of the second class and that neither the Mountain Park Land Company nor its successor, the West Virginia Development Company, has the right to build a dam, as has been planned, the plans of J. S. & W. S. Kuhn, Inc., of Pittsburgh, for constructing a hydroelectric development on this river have been held up. A contract for the construction of a dam and power house on the river near the Pennsylvania line was awarded by the Kuhn interests to a Pittsburgh concern several months ago, as was noted in these columns July 27.

Wisconsin Gas & Electric Bonds.—The incorporation of the Wisconsin Gas & Electric Company as the successor of the Kenosha Gas & Electric Company, the Kenosha Electric Railway Company and the Racine Gas Light Company was noted in these columns Oct. 5, and the names of some of its officers appeared in the issue of Oct. 12. The company has recently sold to Harris, Forbes & Company and Spencer Trask & Company $2,000,000 first-mortgage 5 per cent forty-year bonds, dated June 1, 1912, covering all its properties in Kenosha and Racine, Wis. In addition to its bonds, the company has $1,000,000 common and $200,000 preferred stock outstanding. Its properties consist of 121 miles of gas mains in these two cities and vicinity, 8 miles of electric railway track in Kenosha and a 2200-hp generating station. Gross earnings of the properties in the twelve months ended Aug. 31, 1912, were $614,587 and net earnings were $197,236. Bond interest amounted to $100,000, leaving a surplus of $97,236 available for dividends.

Low Rates Brought Business to Canadian Company.—The utilities commission of London, Ontario, has presented a report of its hydroelectric department which shows that the gross surplus for the first ten months of this year was over $31,000. The figures were made known at the regular meeting of the board and were in brief as follows: For ten months ended Sept. 30, receipts from customers, $79,161; receipts from the city street lighting and waterworks, $31,174; total receipts, $110,335; total expenditure, $78,551. The gross surplus, as above, was $31,784, and deduction of interest and sinking fund to Sept. 30, amounting to $16,737, left a net surplus of $15,046. A large proportion of the surplus was derived from residence and commercial lighting, showing that the company's 4½-cent rate per kw-hr., combined with flat-rate lighting at even less than 4½ cents, was a paying proposition.

Control of Ohio Public Utility Changes Hands.—The Northwestern Ohio Railway & Power Company, which is a subsidiary of the General Gas & Electric Company, whose formation by W. S. Barstow & Company, 50 Pine Street, New York, was noted in these columns July 6, has purchased the properties of the Port Clinton (Ohio) Electric Light & Power Company. Energy will be furnished to the system from the Northwestern company's 1500-kw station at Port Clinton, which is to be enlarged by the installation of a 1700-kva General Electric turbine unit, two 300-hp. Stirling boilers, a Le Blanc condenser and Jones auto-feed stokers, as was noted in the *Electrical World*, Aug. 24.

To Reorganize Central Colorado Power Company.—Owing to the fact that the Central Colorado Power Company of Denver, Col., is not earning the 5 per cent interest on its $12,500,000 bonded indebtedness, as was noted in a reference to its annual report in these columns on Aug. 10, a reorganization of the company will be effected in the early part of next year. New York interests affiliated with the company say that no definite details of the reorganization plan have been perfected as yet. The company has recently closed a contract to supply the Denver City Tramway Company with about 2000 kw.

Abilene (Tex.) Utilities Sold.—The New York banking house of N. W. Halsey & Company has acquired the gas, electric, water and ice properties in Abilene, Tex., formerly operated by the Abilene Light & Water Company, the Abilene Gas, Light, Fuel & Power Company and the Abilene Ice Company. About $100,000 is to be spent upon improvements. Part of this will be for gas mains and part for an additional generating unit for the electric company, but its size is not available at this time.

Nelite Works of General Electric Company Acquires Permel Lighting System.—The Permel system of specific lighting units, whose function is to give a high intensity over small areas as is required in many of the operations in shoe manufacturing and similar industries, has been acquired by the Nelite Works of General Electric Company, and will be marketed by the latter in the future.

Suspicion Not Ground for Removal of Receiver.—Some of the minority stockholders of the Chicago & Oak Park Elevated Railroad Company recently asked the federal court in Chicago for leave to file a petition asking that Samuel Insull be removed as receiver of the company. It was alleged that the interests of the minority stockholders would be jeopardized by the proposed reorganization of the company and its reported amalgamation with the other elevated-railway companies. Judge Kohlsaat held that no circumstances of emergency were shown warranting the removal of the receiver. "The charges are principally innuendo and suspicion," said the court, "and there is no need for the filing of the petition, which is denied." However, the judge made an order permitting complainant's counsel to have access to the books and records of the company, it being alleged that some of the claims presented against the company are excessive and unjust.

Bonds of Burlington (Ia.) Company Offered.—First-mortgage 5 per cent sinking-fund gold bonds of the Burlington Railway & Light Company, of Burlington, Ia., to the amount of $1,400,000, are being offered to investors at 96½. The bonds are dated March 1, 1912, and are due March 1, 1932. The authorized issue is $7,500,000. The company does the electric-service business of Burlington, operates a system of street railways in that city and also conducts a gas plant and a steam-heating plant. The $1,400,000 of bonds now offered are all that are outstanding. Additional bonds can be issued for 80 per cent of improvements when net earnings for twelve months preceding are double the interest charges on bonds outstanding and those proposed to be issued. The net income for 1911 was $151,768.

INDUSTRIAL SECURITIES.

Security.	Capital Stock Listed.	Dividend.		Quotation.	
		Per Cent.	Period.	Oct. 16.	Oct. 23.
Allis-Chalmers t. r. 1st assess. paid	$17,125,800	.....	.....	½	½*
Allis-Chalmers t. r. 2d assess. paid	.....	.....	.....	.....	2⅞*
Allis-Chalmers pf	2,083,800	.....	.....	2*	1*
Allis-Chalmers pf. t. r. 1st assess. paid	13,966,200	.....	.....	3½*	3½*
Allis-Chalmers pf. 2d assess. paid	.....	.....	.....	.....	8½*
Amalgamated Copper	153,887,900	1	Q	89⅜	86⅜
American Tel. & Tel	334,303,300	2	Q	143½	143
Crocker-Wheeler, c	1,700,000	1½	Q	88*	87*
Crocker-Wheeler, pf	500,000	1¾	Q	105*	104*
Electric Storage Battery, c	16,074,425	.....	.....	56	55¾
General Electric	77,726,700	2	Q	182½	180½
Mackay Cos., c	41,380,400	1½	Q	86¾*	86¾*
Mackay Cos., pf	50,000,000	1	Q	68½*	68*
Western Union Tel	99,743,400	¾	Q	79	79⅜
Westinghouse, E. & M., c	31,685,300	1	Q	84½	82⅞
Westinghouse, E. & M., pf	3,998,700	1¾	Q	126*	126*

*Last price quoted.

NEW YORK METAL MARKET PRICES.

	Oct. 15 Bid.	Oct. 15 Asked.	Oct. 22 Bid.	Oct. 22 Asked.
Copper:				
Standard, spot	17.20	....	17.20	....
	£ s d		£ s d	
London, standard, spot	75 7 6		75 5 0	
Prime Lake	17.62½ to 17.75		17.60 to 17.80	
Electrolytic	17.50 to 17.70		17.50 to 17.70	
Casting	17.37½ to 17.50		17.35 to 17.45	
Copper wire, base	19.00		19.00	
Lead	5.10		5.10	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.60		7.60	
Tin, spot	49.35		50.00	
Aluminum:				
Prompt delivery	26.00 to 27.00		26.50 to 27.50	
Future	25.50 to 26.50		26.00 to 27.00	

OLD METALS.

Heavy copper and wire	16.25	16.00
Brass, heavy	10.25	10.00
Brass, light	8.75	8.50
Lead, heavy	4.75	4.75
Zinc, scrap	6.25	6.12½

COPPER EXPORTS IN OCTOBER.

Total tons, week ending	Oct. 15, 12,301	Oct. 22, 13,896

Personal

Mr. Benedict F. Raber has been appointed assistant professor of mechanical engineering at the University of Nebraska, Lincoln.

Mr. D. C. Greene, manager for the Oregon Power Company at Marshfield, Ore., has been elected president of the Chamber of Commerce of that city.

Mr. Robert Reid, until recently with the Pacific Gas & Electric Company, is returning to the Hawaiian Islands to become superintendent in a hydroelectric plant.

Mr. Otto Frick, inventor of the induction furnace bearing his name, is visiting this country for the purpose of introducing his furnace in the iron and steel industry.

Mr. William C. Hawkins, formerly general manager of the Dominion Power & Transmission Company, Hamilton, Ont., has been elected managing director of the company.

Mr. Morgan W. Maghee has been appointed superintendent of the Consolidated Power & Light Company, with headquarters at Lead, S. D., succeeding Mr. C. W. Hough.

Mr. A. B. Hitzel has been appointed contract agent for the Elmira (N. Y.) Water, Light & Railway Company, succeeding Mr. T. B. Rhodes, who has removed to New Orleans.

Mr. J. G. Elliott, owner of the Versailles (Ill.) Electric Company, has sold his plant to the Western Utility Company, of Chicago, and will become manager of the latter company.

Mr. Pearson Macintosh, assistant superintendent of the Newburyport Gas & Electric Company, has recently accepted a position with the Plymouth Electric Light Company, Plymouth, Mass.

Mr. Herbert Markle, who for the past three years has been connected with the Consumers' Power Company at Stillwater, Minn., will enter a larger field of work at Everett, Wash., about Nov. 1.

Mr. Edward P. Coleman, formerly manager of railways of the Dominion Power & Transmission Company, Hamilton, Ont., has been appointed to the position of general manager to succeed Mr. William C. Hawkins.

Mr. Frank W. Linebaugh, formerly manager and superintendent of the Municipal Electric Light Plant at Ames, Iowa, has been appointed manager of the Boone Electric Company, succeeding Mr. Frank K. Shuff, resigned.

Mr. Albert R. Granger, vice-president of the Beacon Light Company, Chester, Pa., retains his position as general manager of the company, not having been replaced by Mr. F. W. Harris as intimated in our issue dated Oct. 19.

Mr. C. B. Rhodes has been appointed power sales manager for the Kansas City Electric Light Company, succeeding **Mr. Harry G. Glass,** who resigned Oct. 1. Mr. Rhodes was formerly with the Empire District Electric Company at Joplin, Mo.

Mr. E. H. Witcraft, who was formerly electrical inspector for the Underwriters' Association of the Middle Department, has become general manager of the Fayette Electrical Engineering Company, Connellsville, Pa., which was recently incorporated.

Mr. H. C. Cummins, who was formerly manager of the Consumers Power Company at Northfield and later at Faribault, Minn., has been assigned by H. M. Byllesby & Company, the owners of the Consumers' Power Company, to their plant at Stillwater.

Mr. Clinton Wallace Hough, formerly general manager of the Consolidated Power & Light Company of Deadwood, S. D., has resigned his position to act as agent abroad for the J. C. Clarke Company of New York and will take up his permanent residence in Europe.

Mr. Andrew N. Fox, vice-president of the Chicago Advertising Association and advertising manager of the Benjamin Electric Manufacturing Company, is delivering a course of advertising lectures under the auspices of the Chicago Y. M. C. A. evening schools.

Mr. William Burnett has been appointed superintendent of elecrical distribution of the Urbana & Champaign Railway, Gas & Electric Company, with headquarters at Champaign, Ill. Mr. Burnett succeeds **Mr. J. D. McKee,** who has become associated with the Ideal Electric Company.

Mr. E. B. Bumsted, who was formerly connected with the Stone & Webster Engineering Corporation and the Stone & Webster Construction Company, has been appointed vice-president of the Oro Electric Corporation and will have charge of the departments of operation and construction.

Mr. Louis H. Egan, general manager of the Kansas City Electric Light Company, is absent on a two months' honeymoon trip, touring Italy and cruising on the Mediterranean. He was married Oct. 2 to Miss Fanny James, a young woman of social prominence in Kansas City, and with his bride departed at once on his European trip.

Mr. Philip L. Spalding, vice-president of the Bell Telephone Company of Pennsylvania, has been elected president of the New England Telephone & Telegraph Company, succeeding Mr. J. N. Keller. Mr. Spalding has been in telephone work for eighteen years, having steadily advanced from the position of inspector to his present duties, and is prominent in Bell circles.

Mr. W. H. Fellows, the newly elected secretary-treasurer of the Kansas Public Utilities Association, is vice-president and manager of the Leavenworth Light, Heat & Power Company, Leavenworth, Kan. Prior to the death of his predecessor, two years ago, Mr. Fellows was chief engineer of the local plant, having served in this capacity for eight years. He was formerly stationed at Springfield, Mo.

Mr. C. C. Burns, of the Watertown (N. Y.) Light & Power Company, has been elected president of the Carthage (N. Y.) Electric Light & Power Company, succeeding Mr. S. M. Strickland, resigned. **Mr. J. B. Taylor** has been elected treasurer to succeed Mr. John L. Strickland, resigned, and **Mr. F. A. Rogers** has been elected secretary and assistant treasurer. Messrs. Taylor and Rogers are both officers of the Watertown (N. Y.) Light & Power Company.

Mr. John Balch, treasurer of the Western Telephone Company, with headquarters at Boston, Mass., has been elected assistant treasurer of the New England Telephone & Telegraph Company. Mr. Balch was formerly associated with the engineering department of the Boston Elevated Railway Company as advisory electrical expert in connection with the building of the original elevated system at Boston, but for the past few years has been occupied exvlusively in telephone work.

Mr. Jasper N. Keller, president of the New England Telephone & Telegraph Company, Boston, Mass., has resigned after twenty-seven years of service with the organization. Mr. Keller is one of the best known managers in the telephone field, having come to New England in 1884 after a successful experience in telephony in Texas and the far West. During his connection with the company its business has grown from 16,000 to 450,000 subscribers, and the securities have been transformed from a non-paying proposition to one of the soundest investments in the market. He will remain upon the board of directors.

Mr. G. L. Enfors has resigned as superintendent of motive power of the Fitchburg & Leominster Street Railway, Fitchburg, Mass., to become chief engineer of the Porto Rico Railway Light & Power Company, Ponce, P. R. Mr. Enfors has been connected with the Fitchburg & Leominster Street Railway for thirteen years. He was chief engineer of the company for five years and superintendent of motive power in charge of the power station and repair shop for the last eight years. Before becoming connected with the Fitchburg & Leominster Street Railway Mr. Enfors was with the Boston (Mass.) Elevated Railway.

Mr. F. H. Hanson, who has been appointed electrical engineer for the Kansas Public Service Commission, Topeka, comes from the staff of the Wisconsin commission, with which he has served since its creation by legislative enactment in 1907. Mr. Hanson was graduated from the University of Wisconsin in 1904 and afterward entered the apprenticeship course of the General Electric Company at Schenectady, N. Y. Later he was employed by the Arnold Company, being detailed on the St. Clair Tunnel electrification and other work. During last summer he received a leave of absence from the Wisconsin commission to assist Mr. W. J. Hagenah in a valuation study of the Cleveland (Ohio) Electric Illuminating Company's steam and electric plant.

Mr. R. Norsa, whose resignation from H. M. Byllesby & Company was noted last week, and who will soon sail for Italy, was graduated from the Polytechnic Institute of Milan, Italy, in 1904. He was for several years in the employ of the Thomson-Houston Electric Manufacturing Company in that country in the design and construction of electric plants. During the two years that Mr. Norsa has been in America he has been associated with the New York Edison Company and with H. M. Byllesby & Company in Chicago. On his return to Milan Mr. Norsa will engage in private practice as consulting engineer. He is an associate of the American Institute of Electrical Engineers and a member of the National Electric Light Association.

Mr. Frank L. Dame, vice-president of the Electric Bond & Share Company, in charge of its operating department since 1909, has tendered his resignation to take effect Jan. 1, 1913. Mr. Dame is also resigning from the following companies in which he is an officer and director: American Power & Light Company, Pacific Power & Light Company, Kansas Gas & Electric Company, San Juan (Col.) Water & Power Company, Durango (Col.) Gas & Electric Company, Carolina Power & Light Company, Yadkin River Power Company, Asheville Power & Light Company and the Southwestern Utilities Corporation. Mr. Dame will take a two or three months' vacation before entering upon new duties. He is a graduate of the Massachusetts Institute of Technology. His early business affiliations were with the General Electric interests in the Pacific Northwest. He then became general manager of the Union Electric Company, of Dubuque, Ia., after which he was appointed engineer for the Electrical Securities Corporation, of New York, shortly after its formation in 1904. He continued in this position until the fall of 1909, when he became a vice-president of the Electric Bond & Share Company.

Sir William Ramsay, who will deliver a course of lectures at the Brooklyn Institute of Arts and Sciences, as announced last week, was born at Glasgow, Scotland, Oct. 2, 1852. He received his university education at Glasgow and Tübingen. He was assistant in the chemical laboratories of Glasgow University from 1872 to 1880. In the latter year he was appointed to the chair of chemistry at University College, Bristol, becoming principal in the following year. He served as president of the Society of Chemical Industry in 1894, the year in which, in association with Lord Rayleigh, he discovered the element argon. In 1895 he found in certain rare materials such as clevite the gas helium which till that time had only been known on spectroscopic evidence as existing in the sun. Three years later, in conjunction with Mr. Morris William Travers, he discovered the existence in the atmosphere of three new gases, neon, krypton and xenon, which form the subject of one of the lectures to be given. Sir William has been a prolific author, his publications comprising many valuable scientific contributions to literature, among some of which may be mentioned "A System of Chemistry," "The Gases of the Atmosphere," "The Molecular Surface Energy of Liquids," "The Element Argon," "Helium, a Constituent of Certain Minerals," "Neon, Krypton and Xenon, Three New Elements of Air," and "The Transmutation of Radium Into Helium." In addition to this he has edited a series of textbooks on chemistry, to which he contributed three volumes. Learned societies and scientific bodies, as well as numerous countries, have honored Sir William Ramsay. He is an honorary member of the Institute of France, of the Royal Academies of Berlin, St. Petersburg, Vienna, Holland, Bohemia, Roumania, Ireland, Turin, Norway and Sweden; of the Academies of Geneva, Frankfort and Mexico; of the Brooklyn Institute of Arts and Sciences, and of the Philosophical Societies of Manchester, Rotterdam and Philadelphia. The order of K. C. B. was conferred upon him by King Edward in 1902. He is also Commander of the Crown of Italy and Officier de Légion d'Honneur.

Construction

BIRMINGHAM, ALA.—Plans for extensions to the North Birmingham municipal lighting system, which have been submitted to the City Commission by Engineer Martin J. Lide, embody a scheme for furnishing electricity for all street lamps in the territory north of Tenth Avenue in North Highlands. The initial cost of such a system is estimated at $7,500.

MOBILE, ALA.—Plans are being considered by the Mobile Chamber of Commerce and the Business League for the installation of an ornamental street-lighting system on Government Street from Catherine Street to Conception Street, a distance of nearly 2 miles. The cost of the lamp standards complete is estimated at $30,000.

ALHAMBRA, CAL.—The Conservative Investment Co. is planning to install ornamental street lamps to be maintained by underground wires on Hildalgo Street in the company's new tract just opening up.

CARPINTERIA, CAL.—Work has commenced on the construction of an electric-light plant at Carpinteria.

LOMITA, CAL.—The Narbonne Ranch Wtr. Co. No. 4 contemplates using electricity for operating its pumps instead of gasoline engines. The Southern California Edison Co. has offered to supply electricity to the above company and three other mutual companies operating under the same name. The company proposes to develop about 500 in. of water and to irrigate about 1600 acres.

LOS ANGELES, CAL.—The City Council is considering an ordinance requiring reinforced-concrete poles for trolley wire supports to be adopted within the fire limits of the city.

LOS ANGELES, CAL.—Several improvements are being made by the Pacific El. Ry. Co. on its lines in Pomona, among which will be the erection of a new substation at Ganesha Junction, where the Pacific Electric Railway connects with the Southern Pacific Railway.

LOS ANGELES, CAL.—The Pacific Lt. & Pwr. Co., of Los Angeles, has awarded the contract for the so-called Big Creek pipe line for its new power plant, which will consist of four units and develop 60,000 hp under heads of 1920 ft. and 1680 ft., to S. T. Henry, of San Francisco. The total length of the pipe line will be 14,000 ft.

LOS ANGELES, CAL.—A petition has been filed with the city clerk by the property owners on Main Street asking for the installation of an ornamental street-lighting system on Main Street from Pico Street to Moneta Avenue. The petitioners also ask for an underground-conduit system large enough to carry all wires now carried on poles in the street.

LOS ANGELES, CAL.—Letters have been sent to the various power companies in the city by the special Council committee, consisting of President George William and Councilmen Bethouski and Whiffen, making inquiries as to whether the companies care to consider propositions allowing the city to acquire portions or all of their plants for the proposed municipal distributing system.

NORDHOFF, CAL.—The Ojai Pwr. Co. will begin immediately work on construction of a power plant here. The company is capitalized at $50,000.

OAKLAND, CAL.—The C. A. Lumber Co. has closed a deal for a lease of 12 acres of water-front property owned by the Western Pacific Railroad at the foot of Kirkham Street. The 1000-ft. wharves will be equipped with electrically driven cranes for handling lumber.

PATTERSON, CAL.—J. H. Evans has applied to the Railroad Commission for permission to construct and operate a telephone system in and around Patterson.

REDLANDS, CAL.—Steps have been taken by residents here to raise a bonus as an inducement to the Pacific El. Ry. Co. to extend its railway to the university grounds.

SAN DIEGO, CAL.—The San Diego Consol. Gas & El. Co., will soon begin work on extensions to its electric conduit system, for which franchises have been granted. The cost of the work is estimated at $105,000.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Great Western Pwr. Co. permission to operate in Suisin, Fairfield and Dixon. The company will erect transmission lines into these three districts and distribute electricity for lamps and motors.

SAN JOSE, CAL.—The Southern Pacific Co. is planning to build an electric railway between San José and the California Redwood Park, a distance of 25 miles.

STOCKTON, CAL.—The San Joaquin Valley El. Ry. Co. is constructing a new substation in Stockton. Plans have been completed and work will begin at once on construction of its railway from Stockton to Modesto.

FLORENCE, COL.—The City Council is contemplating the installation of a municipal electric-light plant. The Arkansas Valley El. Co. now furnishes electrical service here.

NEW HAVEN, CONN.—Capital stock to the amount of $300,000 has recently been issued by the United Illg. Co., the proceeds of which will be used for improvements to its plants and extensions of service to nearby towns. Transmission lines are now being erected to Woodmont in the town of Milford.

SIMSBURY, CONN.—Arrangements have been made whereby the Hartford El. Lt. Co., Hartford, will take over the lighting system of the Simsbury El. Co. in Simsbury, Weatogue and vicinity Jan. 1, 1913. The Hartford company is preparing to extend its transmission line to this place.

THOMPSONVILLE, CONN.—The citizens have voted to extend the street-lighting service from Hazardville to Olin S. Olmstead's corner in Wallop.

WATERBURY, CONN.—Work will begin at once by the Waterbury & Milldale Tramway Co. on the construction of its proposed line from the easterly part of Waterbury through Mill Plain suburb and by summer resorts at Lake Hitchcock, through Marion and Milldale. Charles H. Clark, of Milldale, is president.

WASHINGTON, D. C.—Proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Nov. 1 for furnishing and installing electric wiring, switches, wall plugs, lamps, reflectors, etc., in the Eastern High School, Washington. Specifications and forms of proposals may be obtained from the purchasing officer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 4 for furnishing at the navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 4889—100,000 ft. flexible insulated double conductor; Newport, R. I., Schedule 4892—15,840 ft. electric cable, 6000 ft. single-conductor cable, 12 mine transformers. Applications for proposals should designate the schedules desired by number.

LARGO, FLA.—Bonds to the amount of $10,000 have been voted for the installation of an electric-light plant and water-works system.

MIAMI, FLA.—The Greater New York Mining & Development Co., Miami, Okla., would like to receive prices on electric-light equipment.

MIAMI, FLA.—A company has been organized by M. A. Marshall, of Fort Laudersdale, Fla.; J. C. Rudsill and L. O. Hooper, of Georgia, and others for the purpose of developing property on land south of the government cut to the Norris cut. Electric-light plant, water-works and sewerage system will be installed.

OCALA, FLA.—The Ocala Tel. Co. is planning to rebuild its entire system. It is proposed to install the "drop" system and all wires are to be incased in lead cables and a new switchboard will be installed. Contract has already been awarded for the new building.

ST. PETERSBURG, FLA.—The St. Petersburg & Gulf Ry. Co. is planning to enlarge its power house next spring.

ATLANTA, GA.—Separate sealed proposals will be received by the Commission of Roads and Revenues of Fulton County, Atlanta, until Nov. 9 for furnishing material and labor for plumbing, heating and wiring required in the Fulton County court house as follows: (a) Plumbing, consisting of piping, fittings and fixtures; (b) heating, consisting of piping, fittings, fixtures and ventilating system; (c) wiring, consisting of conduit, wiring and equipment. The building covers an area of approximately 130 ft. x 220 ft., consisting of sub-basement and nine stories. Copies of drawings and specifications may be obtained from the architects, A. Ten Eyck Brown and Morgan & Dillon, 607-610 Forsyth Building, Atlanta, Ga., upon deposit of $20 for each set, which will be refunded upon their return. Clifford L. Anderson is chairman of the Commission of Roads and Revenues.

AUGUSTA, GA.—Proposals will be received by Dr. J. M. Caldwell, chairman, until Oct. 28 for furnishing material and erecting power plant, laundry and kitchen building for the city of Augusta. Plans and specifications may be obtained from G. Lloyd Preacher, of Augusta, architect and engineer.

DECATUR, GA.—Preparations are being made by the Georgia Ry. & El. Co. for the construction of an electric railway from College Street in Decatur extending easterly to a point near Clarkston.

CALDWELL, IDAHO.—The Idaho-Oregon Lt. & Pwr. Co. is planning to erect a high-tension transmission line from Caldwell to Parma, a distance of about 20 miles.

PARMA, IDAHO.—The Idaho-Oregon Lt. & Pwr. Co. is planning to build an electric railway between Caldwell and Weiser, via Parma, a distance of about 50 miles.

BETHANY, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, is securing frontage permits for a transmission line to be erected from Mattoon to this village.

CARROLLTON, ILL.—The Central Illinois Pub. Ser. Co. is planning to rebuild its plant in this city. The work will include the installation of new boilers, new machinery and rebuilding transmission lines. Transmission lines will be erected south through Kane to Jerseyville, north to Roodhouse and west to Eldred. The company is reported to have secured contracts to supply power for the drainage district on the Illinois River.

CHAMPAIGN, ILL.—The residents of West University Avenue have taken steps toward the installation of an ornamental street-lighting system. A committee consisting of R. D. Burnham, William Lewis and D. C. Morrissey has been appointed to take charge of the matter.

CHATHAM, ILL.—The Village Board has awarded the contract for lighting the streets of the village to the Union Tel. Co.

CHICAGO, ILL.—Plans are being considered by the Commonwealth Edison Co. for the installation of a substation in the basement of the Insurance Exchange Building at 1046 Sherman Street, to cost about $21,000. W. L. Abbott is chief engineer.

CHICAGO, ILL.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 25 for new engines, generators, etc., in the United States post office, court house, etc., Chicago, Ill., in accordance with specifications and drawings, copies of which may be obtained at the above office. Oscar Wenderoth is supervising architect.

CHRISMAN, ILL.—The City Council has entered into a 10-year contract with the Georgetown El. Co., Georgetown, to light the streets of the city. The contract calls for 37 street lamps at a cost of $1,300.

COAL VALLEY, ILL.—The Village Board has granted a 25-year franchise to E. C. Walsh, Jr., L. Livingston and Paul Wagner, of Rock Island, to operate an electric-light plant here.

DOWNS, ILL.—The Le Roy El. Lt., Pwr. & Htg. Co. is planning to erect a transmission line to Downs.

EAST ST. LOUIS, ILL.—The Southern Trac. Co. of Illinois has applied for a franchise to lay tracks on several streets in this city.

FILLMORE, ILL.—The Central Illinois Pub. Ser. Co. has been granted a 50-year franchise by the Village Board to operate an electric-light plant here.

GIBSON CITY, ILL.—Arrangements have been made by James Hood and E. L. Allsbury with H. L. Clarke, of Chicago, to erect a transmission line from Gibson City to Paxton to furnish electricity in the latter city.

GIRARD, ILL.—Bids will be received until Dec. 3 for the sale of the municipal electric-light plant, including engines, dynamos and other property.

HARRISBURG, ILL.—The property of the People's Wtr. & Lt. Co. has been purchased by Chicago capitalists, represented by R. W. Waite, of that city.

HINDSBORO, ILL.—The Village Board has granted to Marshall E. Sampsell, of Chicago, a 50-year franchise for the Central Illinois Pub. Ser. Co. here. A contract has also been awarded for lighting the streets of the village under which the company will supply 17 100-watt tungsten lamps and eight 60-watt tungsten lamps. At first electricity for operating the system will be supplied from Arcola and later from Mattoon.

HUMBOLDT, ILL.—The Village Board has granted a 50-year franchise to the Central Illinois Pub. Ser. Co., of Mattoon. The company has also a contract for lighting the streets of the village for a period of five years.

KEWANEE, ILL.—The City Council has granted the Kewanee Lt. & Pwr. Co. a franchise to extend its transmission lines into the recently annexed territory on the east, north and west sides.

LE ROY, ILL.—The Le Roy El. Lt., Pwr. & Htg. Co. is contemplating extending its transmission lines to the Obe Dooley farm, if sufficient business is guaranteed to warrant the expenditure.

METCALF, ILL.—The Village Board has closed a contract with the Central Union Utilities Co. to light the village streets. Transmission lines will be extended from the plant at Paris to Metcalf.

MOUNT STERLING, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, is reported to have purchased the plant of the Mount Sterling El. Lt. & Pwr. Co. for $24,000.

OTTAWA, ILL.—Steps have been taken toward the installation of an ornamental street-lighting system in the business section of the city. A. F. Schock, of the National City Bank, is interested.

PARIS, ILL.—The City Council has entered into a contract with the Central Illinois Pub. Ser. Co. whereby the latter will furnish energy for street lighting and pumping water at the rate of 2½ cents per kw-hr. for the first 20,000 kw-hr. and 2 cents for all additional energy. The city will furnish buildings and install new pumps.

PEORIA, ILL.—Work has begun on the preliminary survey for the Peoria & Galesburg Ry. Co. by C. H. Dunn, park engineer, and C. S. Coffeen, of Chicago. The proposed route touches Canton, Galesburg, Farmington and Lewistown. The company contemplates securing electricity from the plant of the Mississippi River Pwr. Co., at Keokuk, Ia. Horace Clark, of Peoria, and associates are interested.

QUINCY, ILL.—The Central Union Tel. Co. has purchased the property of the Home Tel. Co. here. The Central company has been granted a 35-year franchise.

ST. ANNE, ILL.—The plant of the St. Anne Lt. & Wtr. Co. is reported to have been purchased by the Pub. Ser. Co. of Northern Illinois. The plant will remain under the present management until next spring, when the erection of a transmission line from Kankakee is contemplated.

SALEM, ILL.—The Central Union Tel. Co. has announced that it will seek a franchise in Salem.

SANDWICH, ILL.—The Northern Illinois Utilities Co. has purchased the municipal electric-light plant here.

STOCKTON, ILL.—The property of the Stockton El. Lt. Co. has been purchased by Harrison Smith, of Monroe, Wis.

SYCAMORE, ILL.—The City Council has voted to install ornamental street lamps on the business portion of California and Elm Streets. Property owners on Somonauk Street have presented a petition to the Council asking for lamps there.

VERSAILLES, ILL.—The local electric-light plant, owned by John G. Elliott, has been purchased by the Western Utility Co., of Chicago. Mr. Elliott has been made manager of the company.

WATSEKA, ILL.—The City Council has granted the Union Central El. Co. a 30-year franchise to operate an electric-light plant. The company agrees to contribute $100 per block toward the cost of the installation of an ornamental street-lighting system when the business men provide for cables and poles. It also agrees to install the cable free of charge.

WINDSOR, ILL.—The Village Board has granted the Central Illinois Pub. Ser. Co. a 50-year franchise to construct and operate an electrical distributing system here. Electricity for the system will be supplied by a transmission line from Mattoon.

ANDERSON, IND.—Arrangements are being made to extend the transmission lines of the municipal electric-light plant to North Anderson to supply electricity to operate the factory of the Ames Shovel Co. there. The Ames company will use 125 hp.

GARRETT, IND.—The Kokomo El. Const. Co. has been awarded the contract for the installation of a new lighting system here.

KENDALLVILLE, IND.—Contracts have been awarded by the City Council for equipment for the municipal electric-light plant to cost $29,762 as follows: To the Fort Wayne El. Works, for electrical machinery; to the Allis-Chalmers Co., for engines, and to the Alberger Condenser Co., for condensers. Piping will be done by the National Valve & Packing Co.

BLANCHARD, IA.—At an election held recently the proposition to grant the Lee El. Lt. Co., of Clarinda, a franchise to install an electric-light system was carried.

CEDAR RAPIDS, IA.—The Iowa Ry. & Lt. Co., which is a reorganization of the Cedar Rapids & Iowa City Ry. & Lt. Co., has purchased the property of the Marshalltown Lt., Pwr. & Ry. Co., Marshalltown; the Boone El. Co., Boone; the Marion Lt., Ht. & Pwr. Co., Marion; the Perry El. Lt., Ht. & Pwr. Co., Perry; and the Tama & Toledo El. Ry. & Lt. Co., Toledo. The Iowa Ry. & Lt. Co. is capitalized at $6,000,000.

CENTRAL CITY, IA.—An agreement has been entered into between F. J. Cross, of Central City, and the Cedar Rapids & Iowa City Ry. & Lt. Co., whereby the latter will supply electricity in Central City, Center Point, Walker and probably Urbana. Mr. Cross will supply the towns with energy secured from the plant at the dam across the Wapsie River at Central City. All surplus power that he cannot supply will be furnished by the Cedar Rapids & Iowa City Co. The high-tension lines of the company running between Cedar Rapids and Stone City will be tapped east of Marion for this purpose. The company will also build a high-tension line from Marshalltown to Tama and Toledo next spring. Eventually the company will extend its transmission line from Mount Vernon to Marshalltown and to Boone and Perry.

COLLEGE SPRINGS, IA.—The citizens have voted to grant the Lee El. Lt. Co. a franchise to install an electric-light system here.

DALLAS CENTER, IA.—The Adel Mill Co., of Adel, has submitted a proposition to supply electricity to light the town. The proposition to grant the franchise will be submitted to the voters on Nov. 5.

GLIDDEN, IA.—Arrangements are being made to organize a company to be known as the Scranton-Glidden El. Co. It is proposed to erect a transmission line from Glidden to Scranton and to secure electricity from the municipal electric plant in Glidden. A temporary organization has been formed with A. Moorhead, president; Lee Davis, vice-president; Dr. Kline, secretary; W. W. Anderson, treasurer, and S. C. Johnston, manager.

HUDSON, IA.—Plans are being considered by the Town Council for the installation of a street-lighting system here.

MANLY, IA.—Contracts have been awarded by the Rock Island Railroad for construction of buildings in Manly, which is to be made a division point on its north and south line. The improvements will include ten-track freight yard, roundhouse, turntable, machine shops, power house, water plant, coal chute, etc. The project will involve an expenditure of about $500,000.

MARCUS, IA.—The Village Board has abandoned the plan to call an election to vote upon a bond issue for the construction of a municipal electric-light plant and, it is said, will grant a franchise to a private concern.

OGDEN, IA.—The Minneapolis & St. Louis R. R. Co., it is reported, is contemplating equipping its line between Ogden and Frazer for electrical operation.

BELLE PLAINE, KAN.—At an election held Oct. 15 the proposition to issue $35,000 for the installation of an electric-light plant and waterworks system was carried.

HIGHLAND, KAN.—The Home Tel. & El. Co., which recently sold its telephone exchange to the Northeast Tel. Co., has given the city an option on its electric-light plant. A Council committee is making an appraisal of the equipment. If the report is favorable, an election will be called to vote on the proposition to issue bonds to purchase the plant.

DANVILLE, KY.—The Danville Lt. & Pwr. Co., which was recently taken over by Chicago capitalists, is planning to extend its service to Perryville and Junction City, Ky., and also the construction of an electric railway to those places. F. M. Wilkes is special representative of the new owners at Danville.

IRVINE, KY.—Clyde Gaines has installed electric generating equipment in his theater and is supplying electricity to private consumers. It is expected that a street-lighting system will be installed.

WINCHESTER, KY.—The East Tennessee Tel. Co. has commenced work upon a division from Clay City to Jackson in Breathitt County.

FRANKLINTON, LA.—The electric plant of the Franklinton El. Lt. & Coal Co., operated by M. M. Magee, was recently destroyed by fire, causing a loss of about $3,000.

SHREVEPORT, LA.—Improvements are contemplated by the Shreveport Home Tel. Co. to its system, including an automatic branch exchange in West Shreveport.

VILLE PLATTE, LA.—The Ville Platte El. Lt. & Ice Co. is erecting an electric-light and ice plant here to cost about $30,000. Orders for machinery have been placed.

BANGOR, MAINE.—The question of placing overhead wires underground in the business district is under consideration.

FRYEBURG, MAINE.—The Fryeburg, Stowe & Lovell Street Railroad (horse-car line) has been purchased by interests represented by James J. O'Brien, of Boston, who proposes to extend it to Norway and thence to Bethel and Rumford, and from Fryeburg to Rumford. It is expected that the motive power will be electricity.

BALTIMORE, MD.—Mayor Preston has signed the ordinance providing for submitting the $2,000,000 conduit extension loan to the voters at the election next month.

RISING SUN, MD.—The Town Commissioners are contemplating the installation of an electric-light plant and water-works system to cost about $5,000.

GLOUCESTER, MASS.—The Municipal Council has requested the Gloucester El. Co. to submit a new contract for street-lighting for the next five years, beginning Dec. 1, 1912, when the present contract expires. Plans are being considered for the installation of an ornamental lighting system in the business district. The company has erected four new arc lamps on Main Street for experimental purposes.

HAMPDEN, MASS.—The Central Massachusetts El. Co., of Palmer, is contemplating extending its transmission lines to this town to furnish electrical service here.

LEICESTER, MASS.—Arrangements are being made to equip the Chapel and Shepard mills in Cherry Valley for electrical operation. Electricity for operating the mills will be supplied by the Worcester El. Lt. Co. The mills are now operated by steam power.

LUDLOW, MASS.—The Warren Pwr. Co. has applied to the selectmen for a franchise to erect transmission lines within the boundaries of the town.

SPRINGFIELD, MASS.—Preparations are being made for the installation of ornamental lamps on Court Square. The plans provide for the erection of 33 lamp standards carrying five-lamp clusters.

STERLING, MASS.—Plans are being considered for extending the commercial lines of the municipal electric-light system to different parts of the town, involving an expenditure of about $1,800.

WARE, MASS.—The Central Massachusetts El. Co. has applied to the selectmen for permission to change the street-lighting system here. It proposes to substitute incandescent lamps for the arc lamps now in use.

WEST SPRINGFIELD, MASS.—The Amherst Pwr. Co., which is seeking a franchise to install an electric distributing system here, is negotiating with the Boston & Albany R. R. Co. to furnish electricity to operate the machinery, etc., in the car shops in Merrick.

BATTLE CREEK, MICH.—Plans are being considered to extend the ornamental street-lighting system on Jefferson Avenue to Fountain Street, several hundred feet. A movement has also been started to extend the lamps on East Main Street through to the Grand Trunk station.

BAY CITY, MICH.—The Michigan State Tel. Co., will soon begin the erection of additional toll lines between Bay City and Standish and Tawas City.. The cost of the work is estimated at $12,500.

CHARLOTTE, MICH.—The Commonwealth Pwr. Co. is securing right-of-way for a high-tension transmission line between Charlotte and Eaton Rapids. Arrangements have been made by the company to supply electricity to the Herner Brothers' woolen mills.

MANISTEE, MICH.—The City Council is negotiating with the Manistee Lt.. & Trac. Co. for all-night street-lighting service. As soon as the contract is awarded the company will install 150 new arc lamps which it is understood have already been purchased.

ROMEO, MICH.—The construction of an electric railway from Romeo to Lexington, a distance of about 55 miles, is under consideration. The road will be built over a route for which franchises have already been secured. David Oppenheim, of Detroit, is said to be interested.

SAULT STE. MARIE, MICH.—Sealed proposals will be received until Nov. 19 at the office of the United States Engineer, 337 Federal Building, Detroit, Mich., for an arc-lamp lighting system at Sault Ste. Marie, Further information may be obtained on application to Mason M. Patrick, lieutenant-colonel engineers.

THREE RIVERS, MICH.—Preliminary estimates are being received by Charles Lendick, superintendent of water-works, for a new street-lighting system. The city is contemplating establishing a municipal electric-light plant at a cost of about $75,000 and to have the plant ready for service when the present contract with the Constantine Hydraulic Co. expires in 1913.

DULUTH, MINN.—The Duluth Street Ry. Co. has purchased a site on Thirty-fourth Avenue East and Fourth Street, on which it will erect a new substation.

MONTGOMERY, MINN.—The contract for construction of an electric-light plant here has been awarded to the Northern Construction Co., St. Paul. The cost of the plant is estimated at $25,000. James P. Porteus, of Petersburg, Ind., is interested in the project.

PEQUOT, MINN.—The Pine River El. Lt. & Pwr. Co. has submitted a proposition to furnish electricity to light the village of Pequot.

ROCHESTER, MINN.—The Rochester Milling Co. is making arrangements to operate its mill with electrically driven machinery. The company will generate its own power. Orders have already been placed for the machinery.

SHAKOPEE, MINN.—The city engineer has been authorized to draw up a form of contract with the Minneapolis General El. Co. to furnish electricity to operate the municipal electric-light system and water-works pumping station, the contract to be submitted to the voters at the general election to be held Nov. 5.

VIRGINIA, MINN.—The Mesaba Ry. Co. is erecting a large power house in Virginia on the property of the Virginia & Rainy Lake Co., north of the large mill. This station will be equipped with boilers, engines and electric generating machinery with sufficient output to operate the entire line from Hibbing to Gilbert, a distance of 35 miles. Arrangements have been made whereby the waste from the mill cuttings will be used as fuel for the power plant.

CAPE GIRARDEAU, MO.—At an election held recently the proposition to issue $250,000 in bonds for the construction of a combined water and light plant was defeated. George E. Chappell is city clerk.

CLAYTON, MO.—Paul D. Cable, formerly connected with the North American interests, is reported to be interested in a company which will soon apply to the County Court at Clayton for franchises to supply electricity in the western part of St. Louis County, the eastern part of Franklin County and the northern part of Jefferson County. Fred R. Mott, formerly general manager of the Bell Telephone Co., is also interested in the company.

KANSAS CITY, MO.—The Council has appropriated $4,000 for the installation of additional lamps in the suburban wards.

ST. LOUIS, MO.—The Western Pwr. & Lt. Co. has applied for a franchise for the purpose of doing business in St. Louis County. The company proposes to establish and maintain electric-light and power plants, telephone service, etc., and to engage in a cold-storage business.

DARBY, MONT.—The Clark interests have promised to install an electric-light and water plant in Darby, to cost about $25,000, as soon as the town is incorporated as a city. Steps have been taken to have the town incorporated.

MOCCASIN, MONT.—The Great Falls Pwr. Co., of Great Falls, has purchased a site for its substation here. Work on construction of the station will begin at once. The transmission lines of the company have already been erected to Dover. As soon as the station is completed transmission lines will be erected to small towns in this vicinity. S. E. Peel is constructing engineer.

THOMPSON, MONT.—Plans are being prepared by the Northwestern Development Co. for a 40,000-hp development. Work will not begin on the proposed plant until next year. The offices of the company are located in the Electrical Building, Butte, Mont.

BEATRICE, NEB.—Preparations are being made for the installation of an ornamental street-lighting system in the business district. The plans provide for the erection of 95 lamps to be maintained by underground wires. The lamp standards have not yet been purchased. Energy for maintaining the lamps will be furnished by the municipal electric-light plant.

DONIPHAN, NEB.—Charles F. Holdrege, of Holdrege, Neb., has been engaged as engineer to take charge of construction of the proposed municipal electric-light plant and water-works system. The cost of the work is estimated at about $18,000.

JENSEN, NEB.—Arrangements are being made for the installation of an electric-light plant here to cost about $7,000. The equipment will include a 30-hp oil engine, 20-kw direct-current generator and storage battery. Elmer L. Jensen, of Harvard, Neb., is engineer.

FALLON, NEV.—Proposals will be received until Nov. 21 at the office of the United States Reclamation Service, Fallon, for furnishing gates, valves, operating machinery and appurtenances for Lahontan Dam, Truckee-Carson Project, Nevada. For particulars address United States Reclamation Service, Fallon, Nev., Portland, Ore., or Washington, D. C. A. P. Davis is acting director.

RENO, NEV.—The Sierra Tel. & Teleg. Co. has applied to the County Commissioners for permission to erect and operate a telephone system in Washoe County.

CONCORD, N. H.—The Board of Public Works is contemplating the installation of a new street-lighting system. Tungsten lamps will probably be used.

PORTSMOUTH, N. H.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 2 for additional power-plant appurtenances, including one closed heater, one oil separator, one automatically controlled pump with receiver and necessary valves and piping, all to be installed at the navy yard, Portsmouth, N. H. The cost is estimated at $5,000. Plans and specifications can be obtained on application to the above bureau or to the commandant of the navy yard named. H. R. Stanford is chief of bureau.

BOGOTA, N. J.—The Board of Public Utility Commissioners has approved the ordinance passed by the town granting the Public Service Ry. Co. a franchise to operate an electric railway in Queen Anne Road.

MAY'S LANDING, N. J.—At a mass meeting held recently a committee was appointed to make investigations and secure estimates of the cost of installing a municipal electric-light plant. The Atlantic County El. Co., of Egg Harbor, now furnishes electrical service here.

MILLVILLE, N. J.—The Council has been notified that the order restraining the city from proceeding with the erection of a municipal electric-light plant has been modified by the Supreme Court and that it may now build the plant. An ordinance providing for the installation of a municipal electric-light plant was introduced at a special meeting of the City Council held recently. Plans and specifications for the proposed plant have been completed.

MOGOLLON, N. M.—The Mogollon Gold & Copper Co. is planning to install an electric hoist at its mine in Mogollon.

MECHANICSVILLE, N. Y.—The Duffney Brick Co. is contemplating equipping its plant with electrically driven machinery to replace the present steam plant.

NEW YORK, N. Y.—Sealed bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, until Nov. 4 for installing electric equipment in the additions to and alterations in Public School 39, on Longwood Avenue, between Kelly and Beck Streets. Blank forms, plans and specifications may be seen at the above office.

ROCHESTER, N. Y.—Steps have been taken by the Rochester Ry. & Lt. Co. for the installation of electric lamps in Long Meadow, a subdivision just outside of the city limits on Monroe Avenue. There are about 2 miles of streets in the tract, which will require 100 lamps.

CLAYTON, N. C.—Proposals will be received by D. L. Barbour, town clerk, until Nov. 1, for $60,000 in bonds, of which the proceeds of $15,000 will be used for the installation of an electric-light plant and $45,000 for water-works and sewerage system.

WILKESBORO, N. C.—J. F. Humphries, who has been granted a franchise to install an electric-light system here, owns the Moravian Falls water-power and is planning to develop it.

COGSWELL, N. D.—An electric-light plant is being installed here by Dr. Blakeslee, who was recently granted a franchise by the City Council.

DAWSON, N. D.—Arrangements have been made whereby an electric-light plant and water-works system will be installed here. A dynamo and storage battery will be installed in the mill owned by J. S. Werner. Both dynamo and pump will be operated by power from the engine in the mill.

DEVIL'S LAKE, N. D.—Preparations are being made by the Western Utilities Corpn. for the erection of a new power plant here. Charles L. Pillsbury, Metropolitan Life Building, Minneapolis, Minn., is engineer.

GLEN ULLIN, N. D.—The Harmes Lt. & Pwr. Co. is planning to erect an electric-light plant here. Albert Harmes is engineer.

STARKWEATHER, N. D.—Steps have been taken by the business men for the installation of an electric-light plant here.

TIOGA, N. D.—A company has been incorporated in Tioga for the purpose of supplying electrical service in this town.

CLEVELAND, OHIO.—Revised plans for the combined high-pressure pumping station and lighting department substation to be erected by the city on Lakeside Avenue N. E., east of East Ninth Street, estimate the cost of the building at $100,000. Four high-pressure pumps will be installed next spring.

COLUMBUS, OHIO.—Sealed proposals will be received by S. A. Kinnear, director of public service, Columbus, until Oct. 29 for furnishing one steam-driven wet-vacuum pump and one condensate lift pump for the municipal electric-light plant in accordance with specifications on file in the office of the director of public service and the superintendent of the Department of Lighting, Dublin Avenue, from whom copies may be obobtained.

COLUMBUS, OHIO.—Sealed proposals will be received by S. A. Kinnear, director of public service, Columbus, until Nov. 6 for furnishing two 600-kva and two 400-kva single-phase oil-insulated, water-cooled transformers, 6600 primary and 2200 secondary voltage, in accordance with plans and specifications on file in office of the director of public service and the superintendent of Lighting Department, Dublin Avenue, from whom copies may be obtained.

LAKEWOOD, OHIO.—The Cleveland Ry. Co. is planning to erect a new substation on Constant Street in Lakewood. L. P. Crecelius, of Cleveland is superintendent of power and electrical engineer.

PAINESVILLE, OHIO.—The City Council has authorized the Mayor to appoint a committee to investigate the condition of the municipal electric-light plant and to interview the Cleveland, Painesville & Eastern R. R. Co. in regard to furnishing electricity to operate the municipal electric-light system.

WARRENSVILLE, OHIO.—Proposals will be received at the office of the director of public safety, room 109, City Hall, until Oct. 31 for furnishing and installing two electrically driven pumps for Cooley Farms, Infirmary Division, Warrensville. Specifications may be obtained at the above office. Charles W. State is director of public safety.

FOREST GROVE, ORE.—The Washington-Oregon Corpn., Hillsboro, has submitted a proposition to the City Council offering to take over the municipal electric-light plant and furnish electricity here. The proposition will probably be submitted to the voters.

HOOD RIVER, ORE.—Work has begun on the electric plant of the Hood River Gas & El. Co., which will be enlarged and new machinery installed, including a 300-kw generator and several additional transformers. The dam on Hood River will practically be rebuilt.

KLAMATH FALLS, ORE.—The Pacific Tel. & Teleg. Co. is planning to install a central energy system here. The overhead wires in the business district will be placed underground.

LA GRANDE, ORE.—Surveys have been completed by the Boise Trac. Co., Boise, for an electric railway belting La Grande with Cove, Alicel and Imbler, Ore., a distance of 30 miles.

PORTLAND, ORE.—The contract for power, light and telephone equipment for the new 10-story building for the Multnomah Security Co., Portland, has been awarded to LePage-McKenny & Co., of Seattle, Wash.

CHAMBERSBURG, PA.—A proposition has been submitted to the City Council by Robert Bridges, of Philadelphia, to purchase the municipal electric-light plant. He has offered the city $160,000 for the plant and promised to enter into an agreement to spend $100,000 in repairs and improvements to the system next year.

HARRISBURG, PA.—Notice has been filed that applications will be made for charter for four electric-light companies to be known as the Aspinwall, Sharpsburg, Etna and Millvale Electric Light Companies. The incorporators are: George B. Fehr, James G. Marks, Albert K. Little, James Milholland and Lyman C. Shreve.

HARRISBURG, PA.—Plans are being considered by the Board of Public Works and the Park Commission for the installation of electric lamps along the water front the entire length of the city. Removable standards will be used and cable conduit will carry wires to maintain the lamps the entire distance. The lighting scheme will be in the hands of the Park Commission.

HERNDON, PA.—Notice has been filed that application will be made by F. Q. Hartman, F. P. Edwards, H. Ballantyne and R. E. Hartman on Nov. 15 for a charter for the Valley El. Ser. Co. for the purpose of supplying electricity for lamps, heat and motors in the borough of Herndon.

PINE GROVE, PA.—Notice has been filed that application will be made for a charter for the Pine Grove El. Lt., Ht. & Power Co. by E. J. Thomas, Wallace Drumheller and H. L. Troxell. The company proposes to supply electricity for lamps, heat and motors in Pine Grove.

CHARLESTON, S. C.—Negotiations have been closed whereby James Sottile has purchased the entire shore division of the Charleston Consol. Ry. & Ltg. Co., including all wharf properties, ferryboats and railway line from Mount Pleasant to the Isle of Palms, together with its equipment and power house on Sullivan's Island, for about $500,000. Mr. Sottile is planning to build a railway from Mount Pleasant to McClellanville, operating storage-battery cars over this line for both passengers and freight.

RAPID CITY, S. D.—Contracts have been signed by the Dakota Pwr. Co. and the Consol. Lt. & Pwr. Co., of Deadwood, whereby the former will supply to the latter electricity generated at the Big Bend plant. The contract will amount to about $25,000 per year, and under the terms should anything happen to the plant of the Dakota company the Consolidated company agrees to furnish power for lighting Rapid City from its Pluma plants. The Dakota Pwr. Co. will begin at once plans for erecting a second unit in its plant and extending its transmission lines down Rapid Valley to supply electricity to 12 plants which are being installed for irrigation purposes.

ARANSAS PASS, TEX.—The Council has engaged Charles J. Stanzel, engineer, to take charge of the construction of the proposed electric-light plant. The cost is estimated at $8,000.

BRADY, TEX.—The City Council has called an election to be held Nov. 16 to submit the proposition of the Council entering into a conditional contract for the purchase of the properties of the Brady Wtr. & Lt. Co. to the voters.

FALFURRIAS, TEX.—The property of the Falfurrias Pwr. Co. has been sold to E. C. Lassater, of Falfurrias, for $15,000.

HEARNE, TEX.—The Council has awarded the contract for the construction of a municipal electric-light plant, to cost about $8,000, to the Randell-Lovegrove-Wyman Co., electrical engineer and contractor, of Houston. Arc lamps will be installed in the business district and 60-cp incandescent lamps in the residential sections.

NACOGDOCHES, TEX.—The Mayor has been authorized to secure plans and specifications for the erection of an electric-light plant for the city.

PLAINVIEW, TEX.—Dr. F. S. Pearson, of New York, N. Y., and associates have purchased 60,000 acres of land near Plainview and are preparing plans for placing same under irrigation. It is proposed to install a large electric power plant to operate the pumps. Water will be secured from deep-driven wells.

SHERMAN, TEX.—Preliminary steps have been taken toward the construction of an interurban electric railway between Sherman and Gainesville, via Whitesboro. The Fred A. Jones Co., of Dallas, is interestee.

SALT LAKE CITY, UTAH.—The Utah Lt. & Ry. Co. is contemplating the extension of its Holliday line to the mouth of Big Cottonwood Canyon, a distance of 5 miles.

SALT LAKE CITY, UTAH.—The Utah Pwr. Co. has closed a deal for the purchase of the Bamberger plant at Lagoon, which now furnishes electricity for the Salt Lake & Ogden Railroad. The price paid for the plant is said to be about $150,000.

ALEXANDRIA, VA.—A resolution has been introduced to the Council asking for an appropriation of $1,500 for the installation of 32 electric lamps on Washington Street.

MORTON, WASH.—The Morton El. Lt. Co. has applied to the Board of County Commissioners of Lewis County for a franchise to supply electricity for lamps and motors in the town of Morton.

OLYMPIA, WASH.—Application has been made by Wilbur B. Foshay, representing the Washington-Oregon Corpn., of Portland, for a franchise to supply electricity for lamps and motors in Olympia.

SEATTLE, WASH.—The Puget Sound Trac., Lt. & Pwr. Co. has submitted a proposition to the City Council offering to furnish electricity for street lamps at 1 cent per kw-hr., or a total of $46,110 annually, or at 2¼ cents per kw-hr., including operation and maintenance of street lamps as the lighting system is now operated. The company agrees to pay the city $40,000 annually for the use of its system. This would bring the charges for street lighting to $86,802 annually against $213,000 now charged by the city at a rate of 4½ cents per kw-hr.

SPOKANE, WASH.—The Washington Pwr. Co. is contemplating extending its transmission line from its power plant on the Spokane River to Republic to furnish service to the mines and mills of the camp. The proposed line would be 110 miles in length, taking in the mines of the Chewelah district, thence up the Columbia River, crossing at Kettle Falls and going over the divide of the Sherman range to Republic.

BLACK RIVER FALLS, WIS.—The property of the La Crosse Wtr. Pwr. Co., which controls the Hatfield power and the Winona electric light and street railway properties and supplies electricity to the La Crosse Gas & El. Co., was sold at auction to Fred Vogel, of Milwaukee, representing the bondholders' protective committee and Chicago and Milwaukee trust companies and banks, for $500,000. The property has been in hands of receivers since the Hatfield flood in October, 1911. Repairs have just been completed and the company is to resume operations under the reorganization.

EDGERTON, WIS.—The Edgerton Tel. Co. has increased its capital stock from $18,000 to $25,000. F. W. Coon is president.

CARMANGAY, ALTA., CAN.—The ratepayers have voted in favor of appropriating $10,000 for the purpose of installing an electric-light plant and water-works system here.

EDMONTON, ALTA, CAN.—Plans are being considered by the Edmonton Interurban Ry. Co. for the construction of 300 miles of electric railways connecting Edmonton with numerous towns, coal mines, manufacturing plants, etc., in central Alberta. The first unit of the system, upon which grading work is in progress, will extend from the city limits of Edmonton to St. Albert, a distance of 6 miles. The power house will be erected at St. Albert and will have sufficient output to operate 28 miles of road. Other lines contemplated are: to Beaver Lake and Tofield, 40 miles; Edmonton to Vegreville, 60 miles; Edmonton to Lac Ste. Anne, 56 miles; Edmonton to Namayo, 12 miles; Edmonton to Mewassin, 45 miles; Edmonton to Pigeon Lake, 40 miles; Edmonton to Morinville, via St. Albert, 28 miles. M. Kimpe, managing director, has charge of the work.

NEW WESTMINSTER, B. C., CAN.—Work has been started by the British Columbia Tel. Co. on its underground cable system here, to cost about $24,000.

VANCOUVER, B. C., CAN.—The British Columbia El. Ry. Co., Ltd., has awarded a contract to the Puget Sound Bridge & Dredging Co., Seattle, Wash., for the construction of a large dam on the Jordan River, which will form part of the hydroelectric system that the company is developing. The dam will be 800 ft. x 115 ft. The contract calls for an expenditure of approximately $500,000.

ST. BONIFACE, MAN., CAN.—Tenders will be received by J. B. Cote, city clerk, until Nov. 8 for furnishing and erecting a variable-speed motor and a motor-driven pump capable of delivering either 1,000,000 or 1,500,000 imperial gal. per 24 hours. The pump must be capable of delivering either of these quantities against a pressure of 65 lb. (domestic pressure) and 100 lb. (fire pressure). The current supply in power house is 550 volts, three-phase, alternating current. Plans showing layout and available space may be obtained at the office of the city engineer.

WINNIPEG, MAN., CAN.—Tenders will be received by the chairman of Board of Control at the office of M. Peterson, secretary, until Nov. 15 for furnishing labor and material in connection with extensions of the artesian well-water supply of the city of Winnipeg as follows: Section B—erection of 17 pump houses; C—furnishing and erecting deep-well turbine pumps and motors; D—supply and installation of necessary voltage transformers at the individual pumping stations; E—material for power line construction and erection of same; F—furnishing, delivery and laying approximately 61,000 ft. of steel pipe line with valves and specials. Bids will be received separately and in bulk for the above sections. Plans and specifications and form of tender may be obtained at the office of the city engineer, 223 James Avenue, Winnipeg.

BROOKE, ONT., CAN.—Plans are being considered for extensions to the Brooke Municipal Telephone Co.'s system. New equipment will be required.

LONDON, ONT., CAN.—The Water Commissioners are planning to place new electric lamps on every pole on Dundas Street between Wellington Street and the Fair Grounds. H. J. Glaubitz is engineer.

PARKVILLE, ONT., CAN.—The municipalities of Parkville and Lucan contemplate taking up the matter of erecting a transmission line from St. Mary's through Granton and Lucan to Parkville with the Hydro-Electric Commission. J. H. Laughton is clerk.

ST. CATHARINES, ONT., CAN.—A petition has been presented to the City Council asking that estimates of the cost of hydroelectric power in St. Catharines be secured from the Hydro-Electric Company.

ST. THOMAS, ONT., CAN.—The Canadian Iron Corp. contemplates the installation of three transformers for transforming 13,200 volts, three-phase, 25-cycle current to 550 volts, and also a number of small motors. Specifications may be seen at the office of the company, where tenders will be received.

TORONTO, ONT., CAN.—The municipal fire and light committee has requested an appropriation of $25,000 for extensions to the lighting system of this city.

WINCHESTER, ONT., CAN.—The by-law authorizing the town to enter into a contract with the Hydro-Electric Power Commission for hydroelectric power has been passed.

YARMOUTH, ONT., CAN.—Seven hundred farmers of Yarmouth Township have petitioned the Hydro-Electric Commission for Niagara power.

New Industrial Companies

THE AUTOMATIC TRAIN STOP COMPANY, of Oakland, Cal., has been incorporated with a capital stock of $25,000 by W. A. Stock, J. F. Murphy and William T. Hubbart. The company is capitalized at $25,000 and proposes to deal in an electrical device which it is said will stop the danger of train collision.

THE ECCO ENGINEERING COMPANY, of Springfield, Ill., has been incorporated with a capital stock of $5,000 by John J. Murphy, George E. Conrod and C. E. Harrison. The company proposes to do a general contracting and electrical business.

THE FAYETTE ELECTRICAL ENGINEERING COMPANY, of Connellsville, Pa., has been incorporated with a capital stock of $5,000 by E. T Lynne, C. M. Maxwell and H. A. Porter, of Connellsville.

THE GOLLOS RAILWAY SIGNAL COMPANY OF AMERICA, of Portland, Maine, has been chartered with a capital stock of $1,000,000 to manufacture, sell and install devices for railway signals, switches, etc. T. L. Croteau is president and A. A. Richards, treasurer, both of Portland, Maine.

THE HYDRAULIC STEERING APPARATUS COMPANY, of Lockport, N. Y., has been incorporated by A. C. Buell, of Buffalo; L. S. Wolff and D. F. Carmer, of Lockport, N. Y. The company is capitalized at $150,000 and proposes to manufacture and deal in hydraulic steering apparatus, engines, boilers, etc.

THE LYONS ATLAS COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $500,000 to manufacture and sell engines, boilers, dynamos, automobile engines and machinery of all kinds. The directors are: James W., William F. and George W. Lyons. This company recently purchased the Atlas engine plant in Indianapolis.

THE E. W. MANTER COMPANY, of Boston, Mass., has filed articles of incorporation with a capital stock of $5,000 for the purpose of dealing in lighting machinery. The incorporators are: Everett W. Manter and John B. Sullivan, Jr.

New Incorporations

LESLIE, ARK.—The Leslie Lt. & Pwr. Co. has been organized with a capital stock of $50,000 by E. Moys, W. C. Leonard, E. W. Montrize, H. L. Leonard and Joseph C. Miller. The company proposes to take over the local electric plant and remodel the same. New machinery will be installed.

SPRING VALLEY, ILL.—The De Pue El. Co. has been incorporated with a capital stock of $50,000 by Constant Brown, Charles H. Brown, Roy W. Brown and Harry E. Brown.

KIRKSVILLE, KY.—The Home Tel. Co. has been incorporated with a capital stock of $5,000 by J. T. Long, Marion Coy, W. K. Price and Rufus Blakeman.

FARMINGDALE, N. J.—The Farmingdale Ltg. Co. has been incorporated by William B. Reed, R. S. M. Boyce and Frederic C. Arnold. The company is capitalized at $50,000 and proposes to generate and sell electricity.

PHILLIPSBURG, N. J.—The Phillipsburg Lt., Ht. & Pwr. Co. has been granted a charter with a capital stock of $12,500 to generate and supply electricity in Phillipsburg. The incorporators are: James L. Lemerson, Thomas Newman and Henry Anner.

MADRID, N. Y.—The Madrid El. Lt. Co. has been incorporated with a capital stock of $6,800 by Abner D. Whitney, Lucy M. Whitney and Frederick J. Merriman, of Madrid.

Trade Publications

TURBINES.—The Kerr Turbine Company, Wellsville, N. Y., has just issued its Bulletin No. 26. Photographs of recent installations are shown, size comparisons made and steam consumption curves given.

ROTARY CONVERTERS.—Leaflet 2457, recently issued by the Westinghouse Electric & Manufacturing Company, refers to commutating-pole rotary converters, which are illustrated and described in detail.

ELECTRICAL SUPPLIES.—A six-page oblong folder is being sent out by the Alpha Electrical Supply Company, 130 West Thirty-second Street, New York, the subject of which is "The Audabird and How to Catch Him."

GUY CLAMPS AND GUY ANCHORS.—Two small four-page folders have been issued lately by W. N. Matthews & Brother, 3722 Forest Park Boulevard, St. Louis, Mo., one devoted to Matthews boltless guy clamps and the other to the Matthews guy anchor.

FRICTION TAPE.—"A Tape for Every Requirement" is the title of a small four-page folder issued recently by the Western Electric Company, in which information is given relative to "Victor" and "Amazon" friction tape and "Victor" and "Amazon" splicing compound.

MILL MOTORS.—The Westinghouse Electric & Manufacturing Company has recently issued Leaflet 3506, referring to its motors for pulp-mill service. Illustrations of motors in operation are shown and interesting data are given as to the use of electric motors in the paper industry.

WIRING SUPPLIES.—"Paistery," which is published at intervals by the H. T. Paiste Company, Philadelphia, has for the subject of its recent issue, No. 84, the company's new 2-in. pipe taplets, type LB pipe taplets and Fielding receptacles, a page being devoted to each one of these specialties.

DEMAND INDICATOR.—Bulletin A4002, recently issued by the General Electric Company, describes its polyphase maximum-watt demand indicator, type W. The instrument is suitable for recording the maximum load of alternating-current circuits irrespective of power-factor and voltage fluctuations.

MOTOR CONTROL.—The General Electric Company's Bulletin No. 4977 describes its Type MK control apparatus, which is designed for use where single-car operation predominates and where a uniform acceleration is of less importance than extreme simplicity. This bulletin supersedes, in part, Bulletin No. 4761.

HOISTING SETS.—Leaflet 2444, recently issued by the Westinghouse Electric & Manufacturing Company, covers the equalizer flywheel hoisting sets used in conjunction with electric hoists. A complete hoisting set with motor is shown, and also a diagram of connections, bringing out the liquid rheostat feature.

DRAFTSMEN'S LETTERING SHEETS AND FLEXIBLE RULER.—Kolesch & Company, manufacturers of surveying instruments and drawing materials, 138 Fulton Street, New York, have sent out cards briefly describing their "allstyles" lettering sheets for draftsmen and their parallel flexible ruler and scale protractor.

MACHINE-TOOL MOTORS.—"Rules for the Selection of Machine-Tool Motors" is the title of Leaflet No. 2480, just issued by the Westinghouse Electric & Manufacturing Company. Some valuable condensed information is given relative to the selection of a motor with the proper characteristics for the desired duty.

OIL SWITCHES.—Bulletin No. A4001, recently published by the General Electric Company, describes its oil switches, which are intended primarily for use in small and isolated alternating-current plants of voltages not greater than 3300. The bulletin contains connection and dimension diagrams and also useful formulas.

TUNGSTEN LAMPS.—A four-page folder, some two-page leaflets and a blotter, all of regular envelope size, are being distributed by the Eastern Electric Lamp Company, 141 Milk Street, Boston, Mass., and refer to the Eastern tungsten-filament lamps. The folders and leaflet contain prices and brief mention of the company's product.

FURNACES.—Catalog No. 15 of the W. S. Rockwell Company, 30 Church Street, New York, has recently been published. It is devoted to the Rockwell rotary furnaces for annealing, hardening, tempering, bluing or other heat treatment of small pieces in either brass, copper or steel. Annealing furnaces for electrical work are also made by this company.

CLAY PRODUCTS.—Facts regarding the Laclede-Christy products are succinctly set forth in a large four-page folder, printed on heavy paper in two colors. The back cover gives an imposing list of brick, hollow and glazed ware and some special products manufactured by the Laclede-Christy Clay Products Company, Manchester and Sulphur Avenues, St. Louis, Mo.

COPPER-CLAD WIRE.—The Duplex Metals Company, Chester, Pa., has recently distributed another of its periodical leaflets referring to copper-clad wire, in which a comparison is made of copper wire and copper-clad wire. The statement is made of copper-clad wire that "it does 'come back' and its cost per mile is but one-half that of the No. 10 copper."

MAGNETIC SEPARATORS.—Bulletin No. 13,000 of the Cutler-Hammer Clutch Company, Milwaukee, Wis., is devoted to magnetic separator pulleys for use in cement mills, paper pulp mills, terra-cotta plants, or wherever it is desired to remove continuously the magnetic contents from non-magnetic bulk material. The bulletin contains two illustrations, diagrams and list prices.

DIRECT-CURRENT MOTORS.—Type SK direct-current, commutating-pole motors, built by the Westinghouse Electric & Manufacturing Company, are described in Leaflet 2359-A. The inclosed, back-geared and vertical types of this apparatus, as well as the standard types of motors, are considered in the illustrated text of this leaflet. Brief mention is also made of some of the detail parts.

LAMP CHANGER.—W. N. Matthews & Brother, St. Louis, Mo., call attention to their "easy lamp changer" in a four-page folder recently distributed. Burned-out lamps in high places are frequently not promptly renewed, owing to their not being easily accessible, and this device, because of the case with which such lamps can be handled, reduces the losses caused by failure to replace old lamps with new.

RAILWAY MOTOR CARS.—Booklet No. 119, an August publication of the Chicago Pneumatic Tool Company, Chicago Heights, Ill., gives practical information on the "Operation and Upkeep of Rockford Motor Cars." A good deal of information of a general character is compressed in these twenty-two pages, which also contain a few small illustrations and several full-page diagrams. The last chapter, "Pertinent Points," will be of special value to all users of these cars.

ELECTRIC LOCOMOTIVES.—Circular 1516, on electric locomotives, has just been issued by the Westinghouse Electric & Manufacturing Company. The locomotives which are built by this company jointly with the Baldwin Locomotive Company of Philadelphia are described and illustrated in detail. This publication discusses the field of application of electric locomotives to both steam and electric railways and shows numerous examples on roads throughout the country.

A NEW HOUSE ORGAN.—*The Otto Cycle* made its initial bow to the public in June of this year. It is published monthly and is devoted to a discussion of internal combustion engines in general and the affairs of the Otto Gas Engine Works product and sales organization in particular. As gas engines are used for so many purposes, the contents of this little monthly will appeal to a wide variety of readers. Published in Philadelphia by the Otto Gas Engine Works.

SMALL MOTORS.—Folder 4230 issued by the Westinghouse Electric & Manufacturing Company, entitled "How Westinghouse Small Motors Can Help You," is an attractive twelve-page publication describing some of the manifold uses of small electric motors. The illustrations show actual installations of small motors in the home and in the shop. The publication is intended for dealers and central stations, space being left on the back for the name of the distributing company.

ELECTRICAL SPECIALTIES.—A new twenty-page catalog is being sent out by the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., describing and illustrating its lock switches, flush receptacles, shallow steel wallcases and other electrical devices. In the opening announcement the company states that in a recent test of several switches selected at random the M. & M. switches withstood more than 1,000,000 makes and breaks and endured the test longer than some switches of other make.

FIXTURES FOR THE "EYE COMFORT" SYSTEM.—Some recent loose-leaf literature to be included with other material on the "Eye Comfort" system has recently been distributed and deals with numerous styles and types of fixtures used with this system of indirect illumination. A number of artistic designs are shown, several of which are made of a new material which is called "compone." These sheets are published by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill.

EXHAUST FANS.—Among recent bulletins of the American Blower Company, Detroit, Mich., which supersede others on the same subject, may be mentioned No. 324, devoted to type P "A B C" high-pressure exhaust fans, and No. 344, relating to type V Universal "A B C" cast-iron blowers and exhaust fans. Bulletin No. 347, also recently issued, describes this company's unit heaters. All of these publications contain brief, illustrated matter, with the dimensions and capacities of the apparatus described.

BLOWERS.—Albert J. Kelting, 459 Carroll Street, Brooklyn, N. Y., is distributing his new catalog on positive pressure blowers. The opening pages give comparisons of various methods of moving air against high, low and intermediate pressures, following which is a complete, illustrated description of the Kelting positive pressure blower. The blower operates at moderate speed, no gears are necessary, and it is claimed that it gives a steady, non-pulsating blast owing to the absence of unbalanced moving parts.

ELECTRICAL SUPPLIES.—The Bryant Electric Company and the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn., have recently published a 128-page catalog on their wiring devices. It is an excellently arranged, well-printed publication and contains over 300 devices not previously listed in the catalogs of these companies. A good illustration of at least one type of each device accompanies the specification. An index to catalog numbers and a general index make it easy to locate a particular wiring specialty.

ROCK DRILLS.—The Chicago Pneumatic Tool Company, Chicago, Ill., in its recently distributed bulletin No. 118 deals with its auxiliary valve-type giant rock drills. This type is recommended for use where the material to be drilled is unusually hard and unyielding and the service severe. A brief description with many illustrations of the rock drills make up the eight pages of this bulletin. It is accompanied by Bulletin No. 120, which contains instructions for setting up and operating Chicago giant rock drills, and also for their care.

Business Notes

MR. R. M. CAMPBELL is now associated with the National India Rubber Company, 30 Church Street, New York, and will devote his attention to the sale of bare and insulated wires and cables for every electrical requirement.

THE OVEN EQUIPMENT & MANUFACTURING COMPANY of New Haven, Conn., which manufactures "Sentinel" gas soldering-iron heaters and "Sentinel" gas-torch foot valves, has opened a branch office in Chicago, at 106 South Jefferson Street, where a full line of its devices are on exhibit and for sale.

NATIONAL METAL STAMPING & MANUFACTURING COMPANY.—The Tea Tray Company, of Newark, N. J., has changed its name to the National Metal Stamping & Manufacturing Company in order to signify more nearly the nature of the business now carried on, which includes the manufacture of electric lamps, reflectors and street-lighting fixtures.

THE UNITED ELECTRIC SUPPLY COMPANY, Bush Terminal Building, 241 Thirty-seventh Street, Brooklyn, N. Y., has recently entered the electrical field. The officers of the company are: President, Mr. William D. Ligon; vice-president, Mr. William C. Williams, Jr., and secretary-treasurer, Mr. John A. Thake. The executive offices will be in New York at 34 Nassau Street.

THE AMERICAN CROSS-ARM COMPANY, McCormick Building, Chicago, Ill., is distributing a paper weight in the shape of a miniature four-pin cross-arm, 10 in. in length and 1 in. by 1¼ in. in section, bearing an artistic name-plate which indicates the company's products. Any user of cross-arms who desires one of these paper weights may obtain it by addressing the sales manager of the company.

THE WAGNER ELECTRIC MANUFACTURING COMPANY has just completed a commodious two-story 100-ft. by 400-ft. shop building at its St. Louis manufacturing plant. The new structure is now being equipped with machine tools. Following close upon the completion of this work, the company is already beginning excavation for another new shop building, this one-story structure to be 80 ft. by 350 ft.

ROSENBAUM & STOCKBRIDGE, attorneys in patent cases, 41 Park Row, New York, have announced that Mr. James B. L. Orme is now associated with the firm. Mr. Orme is a graduate of the Massachusetts Institute of Technology and had several years of practical experience as engineer and chemist before entering the practice of patent law, in which profession he has been engaged for a number of years.

CHICAGO ELECTRIC CAR COMPANY.—The recently formed Chicago Electric Car Company has opened handsome salesrooms at 2700 Michigan Avenue, Chicago. Frederick J. Newman, formerly of the Woods Motor Vehicle Company, is president and general manager of this company, which manufactures electric pleasure automobiles. A garage and charging station occupy a considerable portion of the building, but the factory is located elsewhere.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 15, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,041,009. ELECTRIC MOTOR; E. Bretch, St. Louis, Mo. App. filed July 31, 1908. Self-starting, single-phase induction motor.

1,041,061. INDICATING MECHANISM; A. Frisch, Zürich, Switzerland. App. filed April 1, 1912. An indicator card outline is traced by electric sparks.

1,041,066. CONNECTING DEVICE; D. D. Gordon, Chicago, Ill. App. filed Sept. 14, 1911. Lamp socket plug.

1,041,072. PRODUCTION OF ALLOYS; C. A. Hansen, Schenectady, N. Y. App. filed Aug. 6, 1909. Oxides of boron and iron are heated with a carbonizable binder.

1,041,076. VAPOR RECTIFIER AND METHOD OF MANUFACTURE; J. Le R. Hayden, Schenectady, N. Y. App. filed April 16, 1907. The envelope has a gas-absorbing coating of carbonaceous matter.

1,041,994. STEAM BOILER WORKING AS AN ELECTRIC TRANSFORMER; J. Bally, Grenoble, France. App. filed July 5, 1912. Liquid is heated by induction.

1,041,100. TUBULAR INCANDESCENT LAMP; E. R. Knowles, New York, N. Y. App. filed July 1, 1909. The leading-in wires are sealed axially at the ends of the tube.

1,041,103. POWER TRANSMISSION SYSTEM; C. Krämer, Berlin, Germany. App. filed May 15, 1912. For driving an anchor capstan, steering rudder, etc.

1,041,137. MOTOR-CONTROL SYSTEM; R. H. McLain, Schenectady, N. Y. App. filed Aug. 21, 1911. For driving three high plate-rolling mills, etc.

1,041,161. AUTOMATIC CIRCUIT-BREAKER; E. C. Raney, Columbus, Ohio. App. filed Jan. 29, 1912. Branched circuits. (Improvement on patent No. 1,005,575.)

1,041,174. ELECTRIC SIGN; G. Von Saalfeld, Seattle, Wash. App. filed July 1, 1911. Indicating switchboard.

1,041,197. ARC LAMP; E. Thomson, Swampscott, Mass. App. filed Dec. 1, 1909. Dash-pot, feed-checking device.

1,041,220. OUTLET-BOX CONSTRUCTION; J. H. Wyatt and H. C. Campion, Jr., Philadelphia, Pa. App. filed Aug. 23, 1911. Sectional box connections.

1,041,241. ELECTRICALLY HEATED SADIRON; R. E. Clisby, Wellington, Ohio. App. filed May 13, 1912. Non-conducting heating elements, with serrated edges.

1,041,258. SELF-SCORING TARGET; M. St. C. Ellis, U. S. N. App. filed, Jan. 19, 1911. Electro-mechanical type with indicator.

1,041,259. CONTACT-MAKING SHUTTLE FOR SELF-SCORING TARGETS; M. St. C. Ellis, U. S. N. App. filed July 17, 1911. Impact-operated plunger.

1,041,261. ANODE FOR USE BY ELECTROLYSIS OF ALKALINE SOLUTIONS; A. T. K. Estelle, Stockholm, Sweden. App. filed March 6, 1911. The iron anode consists of a solid plate with a layer of pieces resting on it.

1,041,262. PLASTIC MASS FOR METALLIC FILAMENTS; K. Farkas, New York, N. Y. App. filed Aug. 10, 1909. Chromous oxide powder, sulphate of molybdenum and a rubber solution.

1,041,281. METHOD OF MAKING HOMOGENEOUS MECHANICAL JUNCTURES; A. B. Herrick, Ridgewood, N. J. App. filed Nov. 25, 1904. Copper bond and steel rail.

1,041,294. CIRCUIT-CONTROLLING APPARATUS; J. F. Kelly, Pittsfield, Mass. App. filed Aug. 27, 1910. Electrically operated piano, etc.

1,041,300. CABLE CLAMP; J. H. Kliegel, New York, N. Y. App. filed March 15, 1911. For plug switches, etc. (Improvement on patent No. 963,733.)

1,041,322. HEATING AND VENTILATING APPARATUS; F. P. Mies, Chicago, Ill. App. filed May 16, 1910. A fan blower with heating element.

1,041,340. APPARATUS FOR PRODUCING A GASEOUS REACTION; F. W. Peek, Jr., Schenectady, N. Y. App. filed June 23, 1911. Silent discharge for producing ozone.

1,041,349. TROLLEY RETRIEVER; J. R. Ricketts, Los Angeles, Cal. App. filed Oct. 16, 1911. Reel device. (Improvement on patent No. 974,920.)

1,041,354. SELECTIVE SIGNALING; H. O. Rugh and C. S. Rhoads, Jr., Sandwich, Ill. App. filed Aug. 18, 1910. Telephone system with a central station and two groups of substations.

1,041,393. AUDIBLE SIGNAL; H. C. Williams and S. R. Payne, Utica and Syracuse, N. Y. App. filed May 11, 1911. Railroad danger alarm.

1,041,394. ELECTRICAL BONDING DEVICE; H. C. Williams, Utica, N. Y. App. filed May 20, 1911. Cuts into the head and foot of the rail.

1,041,395. ELECTROTHERMOSTATIC LINING FOR VAULTS, SAFES, ETC. J. P. Williams and H. Huhn, New York, N. Y. App. filed Dec. 8, 1910. Laminated structure; burglar and fire alarm.

1,041,398. ELECTRIC-METER AND PANELBOARD CABINET; W. Wurdack, St. Louis, Mo. App. filed Oct. 19, 1910. Main and auxiliary fuses and switches.

1,041,421. PROCESS FOR OZONIFYING; C. S. Bradley, New York, N. Y. App. filed Oct. 29, 1906. Electric discharge in a gas below atmospheric pressure.

1,041,437. TROLLEY GUARD; W. R. Gaggett, Seattle, Wash. App. filed Aug. 10, 1910. Lateral guide fuse.

1,041,456. SAFETY ALARM; J. Gesualdo and F. Baldassarre, Newark, N. J. App. filed Sept. 6, 1911. For gas burners.

1,041,473. TERMINAL BOX; P. Hogan, Brooklyn, N. Y. App. filed Jan. 28, 1911. Two-compartment box for distributing telephone cables, etc.

1,041,482. VOLTAGE COMPENSATING AND REGULATING MEANS; P. O. Keilholtz and F. E. Ricketts, Baltimore, Md. App. filed Dec. 26, 1908. Controlling relay with a small time element.

1,041,514. ELECTRIC-ALARM ATTACHMENT FOR JOURNAL BEARINGS; J. E. Rogers, Beloit, Kan. App. filed Aug. 28, 1911. Thermal alarm.

1,041,525. ELECTRIC DEPOSITION OF METALS; A. P. Strohmenger, Westminster, London, England. App. filed April 11, 1912. Arc welding.

1,041,545. SECONDARY MOUTHPIECE FOR TELEPHONE TRANSMITTERS; S. S. Williamson, Philadelphia, Pa. App. filed Feb. 19, 1912. One-piece structure surrounds the usual transmitter.

1,041,570. SWITCH OR CIRCUIT OPENER FOR HIGH-POTENTIAL CIRCUITS; C. C. Badeau, Swissvale, Pa. App. filed June 16, 1906. A movable terminal in the form of a multi-part chamber containing insulating liquid.

1,041,594. CIRCUIT MAKE-AND-BREAK DEVICE; A. E. Claudon, Denver, Col. App. filed Jan. 25, 1911. For illuminating car steps.

1,041,641. BRAKE-MAGNET PROTECTIVE AND DEMAGNETIZING DEVICE; D. L. Lindquist, Yonkers, N. Y. App. filed March 10, 1909. For protecting an alternating-current magnet, as in elevators.

1,041,642. BRAKE APPARATUS; D. L. Lindquist, Yonkers, N. Y. App. filed April 5, 1911. Elevator control. (Improvement on patent No. 814,669.)

1,041,673. ELECTRIC METAL-WORKING APPARATUS; A. F. Rietzel and G. E. Barstow, Charlestown, R. I., and Lynn, Mass. App. filed May 11, 1907. Double connection to the work-engaging contact, as in chain welding.

1,041,683. LINE CARRIER; L. D. Shaffer, Paint Borough, Pa. App. filed Aug. 21, 1911. For stringing wires. (Improvement on patent No. 850,798.)

1,041,686. BLACK SIGNAL SYSTEM; G. H. Smith, Dayton, Ohio. App. filed Dec. 7, 1910. Duplicate visible and audible railroad cab signal.

1,041,689. ELECTRODE HOLDER; F. T. Snyder, Oak Park, Ill. App. filed April 17, 1911. Water-cooled holder for electric furnaces.

1,041,716. SELECTIVE TIME-LIMIT-CONTROLLING DEVICE FOR ELECTRIC SWITCHES; G. A. Burnham, Saugus, Mass. App. filed July 17, 1911. Selective device operative on overload.

13,480 (reissue). ELECTRICAL WATER HEATER; M. H. Shoenberg, San Francisco, Cal. App. filed Jan 19, 1912. Safety attachment. (Original patent No. 1,005,754, dated Oct. 10, 1911.)